CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

COMPETITIVE SEALED PROPOSALS

FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

LOCKWOOD, ANDREWS & NEWMAN, INC.

APRIL 1, 2014
PORT OF HOUSTON AUTHORITY

REQUEST FOR

COMPETITIVE SEALED PROPOSALS

FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

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LOCKWOOD, ANDREWS & NEWMAN, INC.

APRIL 1, 2014
For the Project set forth below, the Port of Houston Authority is accepting Competitive Sealed Proposals (CSP)

### PART A: Project Information

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Construct Container Yard 6 North at Bayport Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Description:</strong></td>
<td>The Container Yard 6 North project consists of approximately 21.5 acres for container yard operations adjacent to Container Yard 5. The work will include the construction of concrete pavement, underground utilities, electrical work, and security fencing.</td>
</tr>
</tbody>
</table>

Copies of plans, specifications, contract and other CSP Documents for this procurement can be downloaded from the Port Authority’s Vendor Information System (“VIS”), accessed at [http://vis.poha.com/vis/external/default.asp](http://vis.poha.com/vis/external/default.asp) or may be examined at the Port Authority’s Project & Construction Management offices. For security projects, such documents are also available on CD ROM at the office of the Port Authority’s Project & Construction Management, and will be presented to Respondents upon request at no cost.

<table>
<thead>
<tr>
<th>Project Manager:</th>
<th>Barbara Harris</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Manager Email Address:</strong></td>
<td><a href="mailto:bharris@poha.com">bharris@poha.com</a></td>
</tr>
</tbody>
</table>

**Proposal Security (5% of greatest amount proposed):** ☑ Required ☐ Not Required

<table>
<thead>
<tr>
<th>Pre-Proposal Conference:</th>
<th>Date, Time</th>
<th>Place:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May 21, 2014, 11:00 A.M.</td>
<td>Port Authority Bayport Administration Bldg – Large Conference Room (2nd Floor) 12621 Port Road Seabrook, TX 77586</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site Visit:</th>
<th>Date, Time</th>
<th>Place:</th>
</tr>
</thead>
<tbody>
<tr>
<td>None Scheduled</td>
<td>May 21, 2014, 12:00 P.M.</td>
<td>Port Authority Bayport Administration Bldg 12621 Port Road Seabrook, TX 77586</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Due Date:</th>
<th>Date, Time</th>
<th>Place:</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 11, 2014, 11:00 A.M.</td>
<td>See Competitive Sealed Proposal Response form</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Response Opening:</th>
<th>Date, Time</th>
<th>Place:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Same as Due Date), 11:30 A.M.</td>
<td>Port Authority Executive Building 111 East Loop North Houston, Texas 77029</td>
<td></td>
</tr>
</tbody>
</table>

The Response and all required documents shall remain valid for a period of one hundred twenty (120) calendar days after the Response Due Date.

The Port Authority reserves the right to reject any or all Responses.
PORT OF HOUSTON AUTHORITY  
Request for Competitive Sealed Proposals

For detailed instructions regarding the completion of this Competitive Sealed Proposals form and other related forms, or the submission, evaluation, or ranking of proposals, see Instructions to Respondents.

**PART B: Proposal Evaluation Criteria And Weight [CSP Only]**

*See Instructions to Respondents for Explanation of Evaluation Criteria*

<table>
<thead>
<tr>
<th></th>
<th>Relative Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Purchase Price:</td>
</tr>
<tr>
<td>2.</td>
<td>Vendor’s Reputation, Quality of Services and / or Product, Safety Record:</td>
</tr>
<tr>
<td>3.</td>
<td>Benefit to Port Authority:</td>
</tr>
<tr>
<td>4.</td>
<td>Small Business Participation and Local Business Participation: (Small Business Participation Goal for this Project = 30% of the Purchase Price)</td>
</tr>
<tr>
<td></td>
<td>A maximum of 15 Points shall be available for the Small Business Participation criterion and 3 Points shall be available for the Local Business Participation criterion, but the combined total number of points received for the Small Business Participation criterion and the Local Business Participation criterion shall not exceed 15 points</td>
</tr>
<tr>
<td>5.</td>
<td>Overall Compliance with Port Authority Policies</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
</tr>
</tbody>
</table>

Within ninety (90) days of the date of opening of Competitive Sealed Proposals, the Port Authority will evaluate and rank proposals as necessary to select the proposal that offers the best value for the Port Authority based on the evaluation criteria, and otherwise evaluate and rank all other proposals.

**PART C: Additional Requirements (if Awarded a Contract) and Information**

Bonds Required:  ☑ Statutory Performance  ☑ Statutory Payment  ☐ Other (see Special Conditions)

The Work is to be completed:

- ☑ within four hundred twenty (420) working days from the Notice to Proceed.
- ☐ no later than ________________
- ☐ according to the milestone schedule and conditions set forth in the Special Conditions.

The Contract ☑ does / ☐ does not provide for Liquidated Damages for late completion. See the Special Conditions for amounts of any Liquidated Damages.

Questions and Clarifications:

All technical questions and requests for clarification pertaining to the Proposal Documents shall be submitted, at least seven (7) calendar days before the Response is due, using the Port Authority’s Vendor Information System (VIS).

For general questions regarding business with Port of Houston Authority:

- Procurement Services:  713-670-2461
- Small Business Development:  713-670-2597

Dated this **8th** day of May, 2014.

Roger H. Hoh, P.E.  
Director, Project & Construction Management

Yvette Carter-Smith  
Director of Procurement Services

Form Revision Date: April 2014
INSTRUCTIONS TO RESPONDENTS TO REQUEST FOR
COMPETITIVE SEALED PROPOSALS

1. Information Requested
   
a. Provide All Information and Use the Forms: The Competitive Sealed Bid / Proposal Response form must be properly executed at all required locations. All blanks on the Competitive Sealed Bid/Proposal Response form and all required documents must be filled in and provided in the order listed in order for the Response to be considered complete. Any missing information may cause the Response to be considered non-responsive.
   
b. Don’t Change the Forms: No additions, deletions, qualifications or changes in phraseology should be made by the Respondent on, in or to the Bid / Proposal Documents themselves or any form required to be provided as part of the Response.
   
c. Explanations: Explanations which are not intended as limitations or changes in the Response may be included separately with the Response so long as such explanations are made on a separate document designated as such, in writing and signed by the Respondent.
   
d. Not Divisible: Unless otherwise specified in this solicitation, this is not a divisible proposal. Failure to propose on all items may result in rejection of the Response.

2. Communication with Port Authority
   
a. Before Receipt of Responses: Communication with the Port Authority (“PHA”) shall be through PHA’s Vendor Information System (“VIS”), other than as set forth on the Request for Competitive Sealed Bids / Proposals form, and shall be within the time limits set forth in this Instructions to Respondents to Request for Competitive Sealed Proposals. Your questions and PHA’s responses will be posted on PHA’s Vendor Information System. The VIS is accessible at: http://vis.poha.com/vis/external/default.asp and at http://www.portofhouston.com/inside-the-port-authority/purchasing/engineering-specs-and-standards/
   
b. After Receipt of Responses: PHA reserves the right to contact any Respondent for clarification after responses have been received. Respondents are NOT to contact Port Authority personnel regarding the Responses, the evaluation of Responses, or the selection process following the Response Due Date until the Port Commission of the Port of Houston Authority (“Port Commission”) awards a contract for the Project. Any Respondent who violates this no-lobbying rule, or otherwise violates PHA’s Guidelines for PHA Employee Interaction with Contractors, Consultants, and Vendors, may have his or her Response disqualified.

3. Evaluation of Responses and Award of Contract
   
a. All Rights Reserved: The Port Authority reserves the right to accept or reject any or all Responses, and waive formalities to best serve the interests of the Port Authority. Moreover, in case of ambiguity or lack of clearness in any Response, the Port Authority reserves the right to consider the most advantageous construction of, or to reject, the Response. By way of example only:
      
      - Responses not conforming exactly to the Bid / Proposal Documents may be rejected.
      - Responses not incorporating the Port Authority forms required by the Bid / Proposal Documents may be rejected.
      - Unit price Responses in which the prices are, in the opinion of the Port Authority, unbalanced may be rejected.
      - If more than one Response from an individual, firm, partnership, corporation, or joint venture, or combination thereof under the same or different names is submitted, all such Responses may be rejected.
      - The Port Authority may cancel the entire Request for Competitive Sealed Bids / Proposals
      - The Port Authority may issue a subsequent Request for Competitive Sealed Bids / Proposals
b. Errors in Response Price: Errors in extensions of unit prices and addition errors are subject to correction by the Port Authority. In the case of a mathematical error in the extension of the unit price, the unit price shall govern and the total extended price and total proposed price shall be recalculated.

c. Evaluation of Competitive Sealed Proposal Response: The Port Authority has determined that it is in the best interest of the Port Authority to solicit competitive sealed proposals for the Project pursuant to Chapter 60, Subchapter O, Purchase Contracts, of the Texas Water Code.

Each Respondent’s proposal shall remain valid for a time period specified in Part A of the Request for Competitive Sealed Bids/Proposals unless an extension of time is mutually agreed by the Port Authority and the Respondent before the end of that time period.

Unless it elects to reject all proposals, the Port Authority will award the contract after a thorough analysis of proposals submitted based on the published selection criteria. Within the time period specified in Part B of the Request for Competitive Sealed Bids/Proposals, the Port Authority will evaluate and rank proposals as necessary to determine and select the proposal that offers the best value for the Port Authority based on the evaluation criteria, and otherwise evaluate and rank all other proposals. The Port Authority may discuss, with the selected Respondent, options for scope or time modifications and any price changes associated with the modifications. If the Port Authority is unable to negotiate a proposed contract with the selected Respondent that is satisfactory to the Port Authority in its discretion, the Port Authority shall formally, and in writing, end negotiations with that Respondent. The Port Authority may then designate the next remaining proposal that offers the best value for the Port Authority based on the criteria set forth below. If a proposed contract is again not negotiated, such process shall continue in the order of selection ranking until a contract is negotiated, or until all proposals are rejected.

In determining whether a proposal offers the best value to the Port Authority, the Port Authority reserves the right to reject the Response of any Respondent(s) it considers to be not “responsible” to perform the Project. In determining whether a Respondent qualifies as “responsible” (i.e., eligible for award), a number of factors, including but not limited to the following, may be considered. A responsible Respondent must:

1. have the ability to comply with the required delivery or performance schedule, taking into consideration other business commitments;
2. have a satisfactory record of performance;
3. have a satisfactory record of integrity; and
4. have the necessary facilities, organization, experience, authorizations, technical skills, and financial resources to fulfill the terms of the contract for the Project.

Responses rejected due to non-responsiveness and responses from entities considered not “responsible” will not be scored. The remaining responses (the “Eligible Responses”) will be scored as follows:

The selection criteria and relative weights that will be considered by the Port Authority in evaluating each Eligible Response is stated in Part B of the Request for Competitive Sealed Bids/Proposals, in conjunction with the below for the criteria.

- The Purchase Price criterion will be scored as follows:

The Eligible Response with the lowest proposed purchase price (the “Lowest Eligible Price”) will receive the maximum number of the points available in the Purchase Price category.
Each remaining Eligible Response will receive points according to the following formula:

\[
\text{Price Score} = (\text{Available Price Points}) - \frac{(\text{Respondent's Price} - \text{Lowest Eligible Price}) \times (\text{Available Price Points})}{\text{Lowest Eligible Price}}
\]

- In other words, the Port Authority will deduct one percent of the available points in the Purchase Price category for each percentage point the proposed purchase price is above the Lowest Eligible Price. For example, if the relative weight for Purchase Price is 40% (i.e., 40 points), 0.4 points will be deducted for each percentage point the proposed purchase price is above the Lowest Eligible Price.
- The lowest possible score is zero points.
- Calculated scores will be rounded to nearest hundredth (i.e., second decimal place).

- The Vendor criteria includes the following:
  - Reputation of Respondent and of the Respondent's goods or services
  - The Respondent's past performance
  - Quality of Respondent's goods or services
  - Safety and environmental records of Respondent

- The Benefit to Port Authority criteria includes the following:
  - Extent to which the goods or services meet the Port Authority's needs
  - Total long-term cost to the Port Authority to acquire the Respondent's goods or services

- The Small Business Participation criterion includes the following and will be scored as follows:
  - A small business is a firm for which the gross revenues or number of employees averaged over the past three (3) years, inclusive of any affiliates as defined by 13 C.F.R. Section 121.103, does not exceed the size standards as defined pursuant to Section 3 of the Small Business Act and for which the net worth of each owner does not exceed $1,320,000, excluding principal residence and the value of the small business.
  - Small Business scoring is explained in more detail in pre-proposal meetings, therefore attendance by Respondents at any offered pre-proposal meeting is strongly encouraged. Information about Small Business scoring may also be obtained by contacting the Port Authority's Small Business Program staff.
  - To receive points for small business participation, an Eligible Response must meet each of the following requirements:
    1. Small business companies (prime and subcontractors) must be registered in the Port Authority Small Business Development Program at the time of submission of the Response. (A company that is so registered is referred to in these Instructions as a "Port Authority-Registered Small Business.") In order for a joint venture to receive points as a small business, the joint venture itself must be registered in the Port Authority Small Business Development Program at the time of submission of the Response.
2. Respondent's proposed price must be within ten percent of the Lowest Eligible Price.

- Subject to the above requirements, the Small Business Participation criterion shall be scored as follows: provided, however, that the combined total number of points received for Small Business Participation and Local Business Participation will be limited in accordance with Part B of the Request for Competitive Sealed Bids / Proposals:

- Responses submitted by Port Authority-Registered Small Businesses will receive a minimum of one-half of the points available for Small Business Participation. By way of example, if 15 points are available for Small Business Participation, that small business Respondent will receive a minimum of 8 points for Small Business Participation. For each such Response, if that small business Respondent subcontracts any portion of the work to a Port Authority-Registered Small Business subcontractor, the Respondent will receive the percentage of the remaining points available for Small Business Participation corresponding directly to the ratio of the percentage of the work to be performed by Port Authority-Registered Small Business subcontractors compared to the Small Business Development Program Goal for this project set forth in Part B of the Request for Competitive Sealed Bids / Proposals, according to the following formula; provided, however, that the score shall not exceed the number of Small Business Participation points available:

\[
\text{Small Business (SB) Score} = (0.5 \times \text{Available SB Points}) + \frac{(\text{Proposed Subcont. SB Partic. \%}) \times (0.5 \times \text{Available SB Points})}{\text{SB Goal \%}}
\]

- Each Response submitted by a company that is not a Port Authority-Registered Small Business will receive the percentage of the points available for Small Business Participation corresponding directly to the ratio of the percentage of the work to be performed by Port Authority-Registered Small Business subcontractors compared to the Small Business Development Program Goal set forth in Part B of the Request for Competitive Sealed Bids / Proposals, according to the following formula; provided, however, that the score shall not exceed the number of Small Business Participation points available:

\[
\text{Small Business (SB) Score} = \frac{(\text{Proposed Subcont. SB Participation \%}) \times (\text{Available SB Points})}{\text{SB Goal \%}}
\]

- Calculated scores will be rounded to nearest whole numbers.

- The Local Business criterion includes the following and will be scored as follows:

  - Local business scoring is explained in more detail in pre-proposal meetings, therefore attendance by Respondents at any offered pre-proposal meeting is strongly encouraged. Information about Local Business scoring may also be obtained by contacting the Port Authority’s Procurement Services Department.

  - In order to receive points for local business participation, a Respondent must satisfy each of the following requirements at the time of submission of the Response:

    1. The Respondent must have a “principle place of business” within the following eight counties: Harris, Fort Bend, Montgomery, Brazoria, Galveston, Chambers, Waller and Liberty (the “Local Area”).
A Respondent is considered to have a “principal place of business” in the Local Area if the Respondent is headquartered within, or has an established place or places of business within the Local Area, from which 20% or more of the Respondent’s workforce are regularly based, and from which a substantial role in the entity’s performance of a commercially useful function or a substantial part of its operations is conducted. A location utilized solely as a post office box, mail drop, construction trailer, or telephone message center, or any combination thereof, with no other substantial work function, shall not be construed as a “principal place of business.”

In determining eligibility for points for local business participation, only the “principal place of business” of the prime Respondent will be considered. For example, the “principal place of business” of subcontractors or suppliers will not be considered.

2. The Respondent must be certified by the City of Houston as either a “City Business” or a “Local Business” at the time of submission of the Response. In order for a joint venture to receive points as a local business, the joint venture itself must be certified by the City of Houston as either a City Business or a Local Business at the time of submission of the Response.

3. The Respondent’s proposed price must be within:
   i. Five percent of the Lowest Eligible Price if the Lowest Eligible Price is less than or equal to $50,000.00; or
   ii. Three percent of the Lowest Eligible Price if the Lowest Eligible Price is greater than $50,000.00.

   An Eligible Response satisfying each of the above requirements shall receive all of the points available for the Local Business criterion; provided, however, that the combined total number of points received for Small Business Participation and Local Business Participation will be limited in accordance with Part B of the Request for Competitive Sealed Bids / Proposals.

- The Overall Compliance with Port Authority Policies criteria includes full completion of the Competitive Sealed Bid / Proposal Response form and submission of the items required by the Bid / Proposal Documents, including all items set forth in Part C of the Competitive Sealed Bid / Proposal Response form.

- Requirements for Contract: If selected, the Respondent is required to execute the Contract and supporting documents, including all required insurance certificates and Port Authority insurance forms, and return them to the Port Authority within ten (10) calendar days after receipt of the Contract. If the Respondent fails to meet the ten (10) day requirement, the Port Authority may rescind the award. Unless a Contract falls within the delegation limits discussed in Subsection 3.e. below, a Contract is not binding until it is approved by the Port Commission voting in public session, executed by both the Port Authority and the Respondent, and the availability of funds required by the Contract is certified by the appropriate financial officer of the Port Authority.

- Notice of Delegation and Delegation Limits: The Port Commission has authorized the executive director of the Port Authority, or an authorized representative of the executive director, to make routine purchases or contracts in an amount not to exceed $50,000 without obtaining award or approval from the Port Commission.
4. **Bid / Proposal Documents:**

Copies of the Bid / Proposal Documents, including the Contract Documents (including the form of contract, General Conditions, Special Conditions, Drawings, and Specifications), forms for information required as part of the Response, and policies for the Project, can be downloaded from the VIS or may be examined at the Port Authority’s Engineering Department offices. It is the responsibility of each Respondent to ascertain that they have a complete set of the Bid / Proposal Documents, and to check the VIS system prior to submitting their Response to determine that they have received all Addenda.

a. **Errors in Bid / Proposal Documents:** The Port Authority recognizes the Respondent must recognize that the Bid / Proposal Documents may contain errors, omissions and discrepancies. Before submitting its Response, the Respondent shall carefully study and compare the various Bid / Proposal Documents, including the Drawings and other Contract Documents, any information furnished by the Port Authority, and any existing conditions related to the Work and shall observe conditions at the Site. Each Respondent is obligated to notify the Port Authority in writing of any errors, omissions, inconsistencies or other problems it discovers in the Bid / Proposal Documents. Such notification shall be provided to the Port Authority, by posting on the VIS, at least seven (7) calendar days prior to the Response Due Date so that the problem can be resolved and all Respondents can be notified of the resolution and, where appropriate, an Addendum issued. Any such problem not brought to the attention of the Port Authority prior to submission will be subsequently resolved by the Port Authority in a manner solely within the discretion of the Port Authority. Any such resolution shall not give rise to a claim for additional compensation or claim for damages by a Respondent.

b. **Interpretation of Bid / Proposal Documents:** Respondents in doubt as to the meaning of, desiring further information regarding, or desiring further interpretation of the Contract Documents or other Bid / Proposal Document must make request for such information in writing to the Port Authority, by posting on the VIS, not less than seven (7) calendar days before the Response opening date. Answers to all such requests will be given in writing to all Respondents by posting on the VIS, and if the issue resolution results in a change in the requirements of the Project, an Addendum will be posted in the VIS by Addenda. No other explanation or interpretation will be considered official or binding on the Port Authority.

c. **Substitute Materials:** Where Materials or Equipment are specified by brand name, trade name, or manufacturer, only products of those named manufacturers are acceptable unless equal Materials or Equipment of other manufacturers are approved in writing by the Port Authority before submittal of Responses. Therefore, submittal of proposed substitutes must be received in the office of the Port Authority, by posting on the VIS, at least seven (7) calendar days before the Response opening date. The Port Authority will respond to each submittal in writing via the VIS to the company or person submitting the proposed substitute. If a proposed substitution is approved, the Port Authority will issue an Addendum noting the approval. The judgment of the equality of Materials, Equipment or products rests solely with the Port Authority, and his/her decision shall be final.

5. **Subsurface Data and Quantities:**

The quantities shown on the Price Form and other Bid / Proposal Documents are estimates and are for comparison of Responses only, and while such quantities are believed to be reasonably accurate, the Port Authority does not guarantee their accuracy. The Respondent must make its own take-off and base its price or prices on the results thereof. Without limiting the foregoing, any information given in regard to soil data, subsurface data, test borings and similar conditions is to be considered approximate.

6. **Price of Materials and State Sales Tax:**

A place is provided on the Price Form for the Respondent to fill in a blank with an amount in dollars and cents indicating the price of all Materials and other tangible personal property included in the total Response price. This blank must be filled in. The amount to be filled in has reference to all of such Materials and other tangible personal property as are actually incorporated into the final result of the Work covered by the Contract.
“Tangible personal property” means personal property which may be seen, weighed, measured, felt or touched, or which is in any other manner perceptible to the sense. Respondents are cautioned that the tax laws are very restrictive as to what may be purchased tax exempt. No expendables may be purchased tax exempt and equipment rentals must be taxed. All contractors, subcontractors, sub-subcontractors and materialmen must have or obtain all necessary permits and certificates to purchase on a tax-free basis any material purchased in Texas and incorporated into the project.

7. **Preliminary Proof of Workers’ Compensation Coverage:**

The Texas Workers’ Compensation Commission has promulgated Rule 110.110. This rule is very involved as to coverage requirements and proof of such coverage. Due to the length of this rule, applicable provisions of this rule may be found on the Port of Houston Authority website located at [http://www.portofhouston.com](http://www.portofhouston.com) under Business Development, Purchasing Department. Copies are also available upon request at no cost from the Port Authority Purchasing Department. This rule requires, among other things, proof of coverage prior to award of Contract. Respondents must read and completely understand what they must do to fully comply with Rule 110.110.

8. **Financial Statements:**

Respondents may be required to provide additional information, including latest audited financial statements.

9. **Withdrawal of Response:**

Any Respondent may withdraw its Response by submitting a request to withdraw its Response in writing to the Purchasing Manager of the Port Authority prior to the deadline for receipt of Responses.

10. **Forfeiture of Bid / Proposal Security:**

The Port of Houston Authority may require any selected Respondent failing to timely return Contract Documents fully executed to pay to the Port of Houston Authority the full amount of the Respondent’s Bid / Proposal Security.

11. **Return of Bid / Proposal Security:**

The Bid / Proposal Security of the highest ranked Respondent will be retained until the Contract is approved by the Port Commission and the Contract, Bonds and Insurance Certificates are executed and returned to the Port Authority. The Bid / Proposal Security for all other Respondents will be released upon request ten (10) working days after the Port of Houston Authority awards the Contract or rejects all Responses.

12. **Collusion:**

Any or all Responses may be rejected if there is reason to believe that collusion exists among the Respondents, and no party to such collusion will be considered in future Requests for Competitive Sealed Bids or Competitive Sealed Proposals.

13. **Conflicts of Interest:**

All Contractors, Respondents and their officers, employees or agents are positively forbidden to give or lend money, or other thing of value, to the Port Authority, any Port Authority Commissioner, or any officer, employee or family member of those mentioned above.

Should any of the above enumerated persons connected with the Port Authority have a direct or indirect monetary interest in the Respondent’s company or parent company, then, and in that case, such interest and the extent thereof must be divulged in writing to the Port Authority with any Response submitted.
14. **Visitation to Port Authority Executive Office Building**

Port Authority visitors are advised to arrive at least 30 minutes before scheduled meetings or deadlines to ensure adequate time for clearing security checks. Visitors are also advised that vehicles, backpacks, over-sized purses and similar personal belongings may be subject to searches in accordance with federal regulations. Parking at the Port Authority Executive Building is free. Ample spaces are available for personal vehicles.

Visitors must present valid, government-issued photo identification in order to enter Port Authority property. Examples of acceptable forms of identification include:

- driver's license
- state-issued identification card
- passport

Such identification must be presented at the security gate. Then, upon entering the Executive Building, such identification must be given to the receptionist in exchange for a Visitor's Badge. The Visitor's Badge must be displayed by every visitor while in the building or on other Port Authority property. Visitors will exchange their Visitor’s Badge for their driver’s license when they leave the building.

15. **Former Port Authority Employees**

Article VI, Section D of the Port Authority’s Code of Ethics provides that the Port Authority must receive specific approval from the Port Commission before entering into any contract (other than a contract subject to competitive bids) with any Person, Business or Business Affiliate (as defined in the Code of Ethics, available at [http://www.portofhouston.com/inside-the-port-authority/policies-and-procedures/](http://www.portofhouston.com/inside-the-port-authority/policies-and-procedures/)) employing or represented by a Person, who has been, within the preceding 12-month period, an employee of the Port Authority, if the contract relates to a matter for which the employee had responsibility while representing the Port Authority.

In order ensure compliance with the Code of Ethics, Respondent must provide a list, on the form provided by the Port Authority, of the names of:

1. Any employees of Respondent (or any of Respondent’s parents, subsidiaries, sister companies, contractors, subcontractors, or other affiliates) who have been, within the preceding 12-month period (calculated from the date of Respondent’s RFP Response), an employee of the Port Authority; and

2. Any other representatives of Respondent who will be performing work on this project and who have been, within the preceding 12-month period, an employee of the Port Authority.

16. **Local Business Participation**

Respondent shall provide proof of certification by the City of Houston as a “City Business” or a “Local Business” and any additional information regarding its local business participation required by the Port Authority in the form and at the times requested by the Port Authority and warrants that any such information provided to the Port Authority is true and correct.
Port of Houston Authority
STANDARDS FOR EMPLOYEE INTERACTION
WITH INTERESTED PARTIES

A. Overview.

1. The employees of the Port of Houston Authority (the “Port Authority”) hold positions of public trust.

2. It is the policy of the Port Authority that its employees place the public interest above any private financial interest, and strive to instill confidence in the integrity of those who are responsible for the operations and representation of the Port Authority.

3. The Port Authority maintains a Code of Ethics. All employees are required to be familiar with the Port Authority’s Code of Ethics and to fully comply with its requirements.

4. These Standards for Employee Interaction with Interested Parties (the “Standards”) are intended to mandate Port Authority employee conduct beyond the requirements of the Code of Ethics: conduct that promotes integrity and public trust, and avoids any appearance of private gain, conflict of interest, or efforts to influence the decisions of Port Authority employees for personal gain or advantage.

5. The Standards should be interpreted in the broadest sense to accomplish these goals. These are minimum Standards for employee interaction. In addition to the requirements of these Standards, every employee should use his or her best judgment with respect to interactions with any Interested Party (as defined below).

B. Definitions.

1. “Benefit” means anything reasonably regarded as monetary or pecuniary value, gain, or advantage, including benefit to any other person, if an employee potentially receiving a benefit has the ability, or potentially has the ability, to impact the benefit-giver’s financial or business welfare.

2. “Interested Party” means any person or entity that is seeking official action by the Port Authority, or has interests that may be substantially affected by the performance or nonperformance of a Port Authority action.

3. “Potential Customers” means persons or entities whose business or trade, if secured, would result in significant commercial or economic benefits for the Port Authority or the Port of Houston.

4. “Widely Attended Event” means an event for which all of the following criteria are met:
a. The employee expects that a large number of persons (i.e. 20 or more individuals, including spouses and guests) will attend the event.

b. The employee expects that persons with a diversity of views or interests will attend the event. This requirement can be satisfied if:

i. The event is open to the public or to persons throughout an industry or profession,

ii. Those in attendance will represent a range of persons interested in a given matter, or

iii. There will otherwise be a significant diversity of views or interests present.

c. The employee’s attendance is in the interest of the Port Authority.

d. The cost of attendance of the employee and spouse/guest will be paid for:

i. By the sponsor of the event, or

ii. By someone other than the sponsor, if the employee expects that more than one hundred people will attend the event, and the gift of free attendance has a market value of Two Hundred Sixty Dollars ($260) or less (or One Hundred Thirty Dollars ($130) or less per person if a spouse/guest will also receive free attendance).

5. “Working Meal” means a meal served in a business office or similar location, at which the attendance of an employee is necessary to conduct Port Authority business during the meal period.

C. Restrictions on Benefits Provided by Interested Parties. Except as provided below, Port Authority employees shall not directly or indirectly accept any Benefit, including any gift of food, goods, entertainment, services, money, lodging, or transportation, from any Interested Party, including without limitation, any person or entity:

1. that does business or seeks to do business with the Port Authority;
2. subject to regulation by the Port Authority, including through inspections or the issuance of permits or licenses;

3. acting as lobbyist, agent, or consultant to any person or entity seeking official action by the Port Authority;

4. that has obtained, or seeks to obtain, Port Authority funding, or sponsorships or other monetary or material in-kind Port Authority support; or

5. engaged in litigation or who has a known claim against the Port Authority, including legal counsel representing litigants or claimants.

D. Exceptions.

1. Reliance on these Exceptions. The following exceptions should be relied upon sparingly and carefully. If an employee is aware of any circumstance that creates or could create a conflict of interest, or give the appearance of impropriety, undue influence, or conflict of interest, he or she should not rely on the exceptions below, and should not accept the Benefit.

2. Certain Benefits. Port Authority employees may accept the following unsolicited gifts from Interested Parties:

   a. a gift distributed generally as a business custom, cultural tradition, or means of advertising, if the total estimated value of the gift is Fifty Dollars ($50) or less and the receipt of such Benefit is required for a substantial Port Authority business development purpose;

   b. a Benefit conferred on account of kinship or on account of a personal, professional, or business relationship, independent of the employee’s relationship with the Port Authority; or

   c. a ceremonial or commemorative gift accepted on behalf of the Port Authority, provided that the employee promptly delivers the gift to his or her manager and does not keep it for personal use.

3. Widely Attended Events. Port Authority employees may accept unsolicited admission, food, gifts (as provided in Section D(2) above, transportation, and entertainment as a guest of or participant in a Widely Attended Event.

4. Working Meal. Port Authority employees may accept food as a participant in a Working Meal.
5. **Business Development Activities.**

a. **Policy Statement.**

i. In order to compete with out-of-state and private operators of ports, waterways, and terminal facilities, it is necessary for the Port Authority to engage in significant business development and marketing activities. Therefore, from time to time, appropriate Port Authority employees may engage in business development and marketing activities on behalf of the Port Authority or the Port of Houston, with the aim of securing business with Potential Customers.

ii. Such business development activities may include the sharing of meals and entertainment, and the exchange of gifts with Potential Customers.

iii. In these circumstances, the Port Authority employees should observe prevailing business customs, but should avoid accepting any Benefit so significant as to create the appearance of impropriety, undue influence, or conflict of interest.

b. **Business Development Rules.** The following rules apply to the giving and receiving of Benefits including gifts by Port Authority employees engaged in business development and marketing activities with Potential Customers.

i. Port Authority employees may provide business meals and entertainment to Potential Customers in connection with business development and marketing activities, provided that they make reasonable efforts to control the costs of such meals and entertainment, giving consideration to the business purpose, location, and other circumstances of such occasions. Such business meals and entertainment must relate to bona-fide Port Authority or Port of Houston business, or be reasonably expected to provide a business benefit to the Port Authority or the Port of Houston.

ii. Where it is reasonably foreseeable that refusing a particular Benefit offered by a Potential Customer would impair the Port Authority’s business development and marketing activities with respect to that Potential Customer, a Port Authority employee may accept such Benefit, provided that: (a) the Benefit is not so large as to create the appearance of impropriety, undue influence, or conflict of interest; (b) the employee attempts, to the extent practicable, to accept the Benefit on behalf of the Port Authority; and (c) the employee discloses the Benefit pursuant to the disclosure requirements set out in Section D(5)(b)(iii) immediately below.
iii. In the event that a Port Authority employee accepts a Benefit from a Potential Customer, the employee should, as soon as reasonably possible: (a) record the nature of the Benefit and its market value (or, if not readily ascertainable, its estimated market value); (b) inform the person to whom he or she directly reports of his or her acceptance of the Benefit; and (c) provide a written disclosure, describing the nature and value of the Benefit, to the Port Authority Legal Division. If the total value of the Benefit (excepting any food, entertainment, services, lodging, or transportation used as a guest) exceeds Fifty Dollars ($50), the employee shall promptly deliver the Benefit to his or her Port Authority manager and shall not keep it for personal use.

E. Restrictions on Procurement Lobbying.

1. Except as provided below, Interested Parties shall not communicate with Port Authority employees regarding their proposals or bids, from the time those proposals or bids have been submitted to the Port Authority, until the time that the subject of those proposals or bids has been finally acted on by the Port Authority.
   
   a. Interested Parties may respond to inquiries from Port Authority employees, as part of the staff’s administration and evaluation of proposals or bids.
   
   b. Port Authority employees and Interested Parties may engage in authorized negotiation of the contract that is the subject of the proposal.

2. Every Port Authority written procurement solicitation, including any request for proposals, request for qualifications, or invitation to bid, shall contain a statement describing this prohibition against procurement lobbying and the penalties for violations of this prohibition.

F. Additional Disclosure Requirements.

1. If a Port Authority employee has a “Material Interest” (as defined by the Port Authority Code of Ethics) in a business, contract, or property being considered by the Port Authority, the employee shall not participate in the consideration of the matter, and shall immediately disclose the existence of such Material Interest to his or her supervisor.

2. Every Port Authority employee shall immediately disclose to his or her department or division superior, or the Executive Director or General Counsel, any conduct whereby any person, including any Interested Party (i) violates or attempts to violate the no-lobbying provisions of these Standards, (ii) improperly attempts to influence Port Authority decision-making, or (iii) otherwise violates or attempts to violate these Standards.
G. **Procurement Confidentiality.**

1. Information relating to the staff’s evaluation of proposals or bids and/or the possible ranking of proposers or bidders, during the time of staff administration and evaluation, is confidential, and shall not be disclosed to any proposers or bidders or their agents.

2. This prohibition does not apply to the following:
   
a. Authorized negotiation of the contract that is the subject of the proposal or bid, between the responsible Port Authority employees and a contractor, consultant, or vendor, or

   b. Disclosure to proposers of staff recommendations or proposed evaluations, following completion of staff work preparing such recommendations or evaluations and distribution to the Port Commission of the preliminary agenda for the meeting at which the contract will be considered, if applicable.

H. **Penalties.**

1. Employees who violate these Standards may be subject to sanctions and penalties, including official reprimand, suspension of employment, or dismissal from employment.

2. Any Interested Party that offers, confers, or agrees to confer any Benefit as consideration for a Port Authority employee’s decision, opinion, recommendation, or other exercise of discretion as a public servant, or otherwise violates or attempts to violate these Standards, may be subject to the following penalties:
   
a. The Port Authority may terminate its existing Port Authority contracts, and

   b. The Port Authority may exclude it from future Port Authority business for a period of time as determined by the Port Commission.

I. **Advice Regarding these Standards.**

1. Employees who have questions about the application of these standards (or of other Port Authority ethics policies, including its Code of Ethics) to particular situations should seek advice from a Legal Division attorney, in advance of taking action where possible.
Standards for Employee Interaction
With Interested Parties
January 2013
Page 7

2. Disclosures made by an employee to a Legal Division attorney may not be protected by the attorney-client privilege.

3. An employee who obtains advice from a Legal Division attorney regarding the application of these Standards (after fully disclosing all relevant facts), and acts in good faith reliance on that advice, shall not be subject to sanctions or penalties, even if that action is later found to constitute a violation of these Standards or other Port Authority ethics policies. However, if the employee has knowledge or reason to believe that the advice he or she received was based upon fraudulent, misleading, or otherwise incorrect information, that employee’s reliance upon the advice is not deemed to be in good faith, and sanctions or penalties may be appropriate.

4. Where an employee’s actions violate a criminal statute, reliance on the advice of a Legal Division attorney does not prevent prosecution of the employee for such violations.
The Port of Houston Authority (Port Authority) is committed to protecting our port facilities, and providing a secure environment for all employees, tenants, and stakeholders at its port facilities.

The Port Authority shall enforce the laws, preserve the peace, and work cooperatively with the public within the framework of federal, state and local regulations and to meet maritime security requirements of the Maritime Transportation Security Act (MTSA) of 2002, as amended, specifically 33 CFR, Parts 101 and 105.

We dedicate ourselves to the unimpeded transportation of cargo, and to the protection and security of these facilities, which are a critical asset to this community, state, and nation.

It is a goal of the Port Authority to be recognized by the maritime industry as a model port for its development of programs, policies, procedures, and implementation of maritime security efforts.

It is the Port Authority’s intent to:

- Prevent loss or harm from threats to health, welfare, and assets.
- Monitor, evaluate, and implement programs for continued security improvement.
- Be proactive in emergency response planning to ensure operational recovery.
- Maximize port security while expediting the flow of commerce.

The Port Authority is committed to the spirit and intent of this policy and the laws, rules, and regulations that gave it foundation.

Roger Guenther  
Executive Director  
Port of Houston Authority
The Port of Houston Authority is committed to conducting port operations using a systematic approach to environmental management in order to protect and preserve the natural environment. In striving to be the recognized maritime industry leader in environmental stewardship, the Port of Houston Authority commits to:

- Meet or exceed all applicable local, state and federal environmental rules, regulations and laws;
- Incorporate environmental stewardship and pollution prevention in all business decisions, best management practices and policy programs, and communicate these activities to stakeholders;
- Continuously evaluate and improve environmental activities and practices to achieve environmental goals; and
- Collaboratively engage businesses, communities, and other stakeholders to assist in achieving environmental goals.

The Port of Houston Authority is committed to the spirit and intent of this policy and the laws, rules and regulations, which give it foundation.

Roger Guenther  
Executive Director  
Port of Houston Authority
Port of Houston Authority
Competitive Sealed Bid / Proposal Response

For detailed instructions regarding the completion of this Competitive Sealed Bid / Proposal Response form and other related forms, or the submission, evaluation, or ranking of proposals or bids, see Instructions to Respondents.

Mail and/or Deliver To:
Port of Houston Authority
Executive Office Building
Attn: Procurement Services – Bid Receipt
111 East Loop North
Houston, Texas 77029

The Respondent must submit **one completed original and five (5) copies** of his or her Response in a sealed envelope or package. On the outside of the sealed Response envelope or package, the Respondent must:

1. Write the company name and address in the UPPER LEFT HAND CORNER
2. Write the exact project title on the LOWER LEFT HAND CORNER

All blanks on this Competitive Sealed Bid / Proposal Response form must be filled in and all required documents must be provided in the order listed in order for the Response to be considered complete. Any missing information may cause the Response to be considered non-responsive. For detailed instructions regarding the submission of Responses, or the completion of this form and other related forms, see the Instruction to Respondents.

## Part A: Project

**Project Name:** Construct Container Yard 6 North at Bayport Terminal

**Response Due Date and Time:** June 11, 2014 @ 11:00 A.M.

## Part B: Respondent Information

The full company name and filing/licensing number of the Respondent should be written exactly as listed with the Office of the Secretary of State for the State of Texas or other licensing entity.

| Respondent Company Name: | | |
|--------------------------|--------------------------|
| **Respondent Contact Person:** | **Name:** | **Phone #** | **Email:** |
| **Title:** | **Fax #** |

| Respondent Company Street Address: | | |
|-----------------------------------|--------------------------|
|----------------------------------------------------------------------------------|
|                                                                                |
|                                                                                |

**Respondent Company Filing / License Number:**

- [ ] Federal Tax I.D. _______________
- [ ] Texas Secretary of State File Number (10-digit) _______________
- [ ] Other Out-of-State filing or license number _______________

**Respondent Company Business Entity Description:**

- [ ] Corporation  [ ] Sole Proprietorship  [ ] Partnership
- [ ] Joint Venture. Members of Joint Venture are: _______________
- [ ] Other: _______________

Form Revision Date: March 2014
PORT OF HOUSTON AUTHORITY  
Competitive Sealed Bid / Proposal Response  

For detailed instructions regarding the completion of this Competitive Sealed Bid / Proposal Response form and other related forms, or the submission, evaluation, or ranking of proposals or bids, see Instructions to Respondents.

| If Respondent Company Business Entity is privately held, please list all equity owners and their contact information: (If not enough room, list on separate sheet) |
|---|---|---|
| Name | Address | Telephone |
| | | |

Part C: Response Attachments

Complete and attach the following required documents to the Competitive Sealed Bid / Proposal Response in the order listed below. Except as noted below, all required attachments are due to be submitted as one package by the Response Due Date. Those noted below as not required by the Response Due Date are due to be submitted by 11:00 A.M. the day following the Response Due Date in a sealed envelope to the same address as the Response. Regardless of delivery method or circumstance, any Response received after the specified time and date will be returned to the Respondent unopened. Any Response submitted using forms other than those provided by the Port Authority, when such forms are provided, or excluding any of the documentation requested, may be rejected by the Port Authority.

<table>
<thead>
<tr>
<th>Attach to Response Following Day</th>
<th>Attachment No.</th>
<th>Attachment Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>☒</td>
<td>01</td>
<td>Price Form, including Price Exhibit</td>
</tr>
<tr>
<td>☒</td>
<td>02</td>
<td>Bid / Proposal Security (PHA Bid / Proposal Bond form, Cashier’s Check*, or Certified Check*)[2]</td>
</tr>
<tr>
<td>☒</td>
<td>03</td>
<td>Project Experience Form (Last 5 projects awarded &amp; additional relevant experience)</td>
</tr>
<tr>
<td>☒</td>
<td>04</td>
<td>Professional References Form</td>
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<td>☒</td>
<td>05</td>
<td>Safety Record Data Form</td>
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<tr>
<td>☒</td>
<td>06</td>
<td>Background Information Form</td>
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<td>☒</td>
<td>07</td>
<td>Work Breakdown Form</td>
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<td>☒</td>
<td>08</td>
<td>Small Business Plan</td>
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<tr>
<td>☒</td>
<td>09</td>
<td>Small Business Participation Letters of intent</td>
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<tr>
<td>☒</td>
<td>10</td>
<td>Small Business Participation Good Faith Effort</td>
</tr>
<tr>
<td>☒</td>
<td>11</td>
<td>Certificate of Residency</td>
</tr>
<tr>
<td>☒</td>
<td>12</td>
<td>Disclosure of Former Port Authority Employees</td>
</tr>
<tr>
<td>☒</td>
<td></td>
<td>Other</td>
</tr>
</tbody>
</table>

[1]: Except where noted otherwise by “*”, each attachment submitted must be on the Port of Houston Authority form included in the Bid / Proposal Documents.

[2]: Cashier’s Checks and Certified Checks must be drawn on banks insured by the F.D.I.C. Uncertified company or personal checks, money orders, cash or other forms of security are not acceptable. All Bid / Proposal Bonds must be furnished on the Port Authority’s Bid / Proposal Bond form, provided in the Bid / Proposal Documents. Bid / Proposal Bonds must be executed by a corporate surety duly authorized and admitted to do business in the State of Texas and licensed by this State to issue surety bonds. The surety must be listed in the current issue of the Federal Register, Department of the Treasury list and must show adequate bonding capacity for the size of the proposed Port Authority project. The Port Authority will not accept bonds from surplus lines or Texas Lloyds Plan insurance companies. The Port Authority shall be the sole judge of the validity and adequacy of any and all bonds submitted.
**Part D: Acknowledgement of Addenda and Port Authority Policies, Programs and Guidelines**

The Bid / Proposal Documents may be modified by Addenda. Each Respondent shall ascertain that it has a complete set of the Bid / Proposal Documents, including those modified by Addendum. Respondent can obtain a complete set of the Bid / Proposal Documents on the Vendor Information System. A complete set will be on file at the office of the Port Authority Contract Representative, 111 East Loop North, Houston, Texas 77029, available for viewing by all Respondents for comparison. By entering the No. and Date below of each addendum issued for this project, the Respondent acknowledges receipt and review of each addendum and incorporation of the addendum in its Response.

<table>
<thead>
<tr>
<th>Addendum No.</th>
<th>Addendum Date</th>
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<tbody>
<tr>
<td></td>
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</tbody>
</table>

Each Respondent is responsible for obtaining and reviewing the Port of Houston Authority policies, program information and guidelines listed below. By checking the boxes below, Respondent acknowledges that it has obtained and read the following Port of Houston Authority policies, program information and guidelines, and that it agrees to be bound by and to comply with such policies, program information and guidelines in connection with the Project, including, in connection with the Port Authority’s Small Business Development Program, providing information regarding its small business participation in the form and at the times requested by the Port Authority. A copy of the Port of Houston Authority’s policies, program information and guidelines may be obtained at the Port of Houston Authority’s Executive Office Building, 111 East Loop North, Houston, Texas 77029, or on the Port of Houston Authority’s website [http://www.portofhouston.com](http://www.portofhouston.com) under Inside the Port Authority.

- [ ] Security Management Policy
- [ ] Environmental Compliance Policy
- [ ] Small Business Development Program
- [ ] Guidelines for PHA Employee Interaction with Contractors, Consultants, and Vendors

**Part E: Validity Period**

The Response and all required documents shall remain valid for a period of one hundred twenty (120) calendar days after the Response Due Date.
**Part F: Execution Block**

Respondent proposes to furnish labor, services, products, materials, apparatus, equipment, tools, supplies, transportation, supervision, insurance, incidentals, and all other things necessary to construct, complete in every detail, the Project all in accordance with the Contract Documents, as defined in the General Conditions included in the Bid / Proposal Documents, for the price set forth in the Price Form and Exhibit submitted herewith and utilizing the entities set forth in Work Breakdown Sheet submitted herewith.

In submitting this Response, the Respondent represents and warrants to the Port of Houston Authority that the Respondent has:

1. satisfied itself with all circumstances affecting the site and the Work and is satisfied with the sufficiency of the Contract Documents, as defined in the General Conditions included in the Bid / Proposal Documents;

2. obtained or will obtain upon award all of the insurance required by the Contract Documents; and

3. reviewed and complied with all requirements of the Instructions to Respondents and other requirements for submitting a Response and that the Respondent accepts and agrees to be bound by all conditions and requirements for such Response. In particular, but not by way of limitation, the Respondent acknowledges and agrees that the Port of Houston Authority has the right to reject any and all Responses, that the Port of Houston Authority has the right to waive any and all formalities, that the Responses will be evaluated based upon the criteria set forth in the Instructions to Respondents, and that the Response will remain valid for the time set forth in Part D of this Competitive Sealed Bid / Proposal Response.

<table>
<thead>
<tr>
<th>Signature of Authorized Signatory:</th>
<th></th>
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</table>

<table>
<thead>
<tr>
<th>Printed Name of Signatory:</th>
<th></th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Printed Title of Signatory:</th>
<th>Date:</th>
</tr>
</thead>
</table>

If Respondent IS a Corporation:

<table>
<thead>
<tr>
<th>Signature of Corporate Secretary</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Printed Name of Corporate Secretary</th>
<th>Date:</th>
</tr>
</thead>
</table>

If Respondent IS NOT a Corporation:

<table>
<thead>
<tr>
<th>Signature of Witness:</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Printed Name of Witness:</th>
<th>Date:</th>
</tr>
</thead>
</table>

*This Response must be properly executed. If the Response is made by a sole proprietorship, the Response must be signed by the owner; if the Response is made by a partnership, the Response must be signed by a general partner; if the Response is made by a corporation, the Response must be signed by the president or vice-president of the corporation and countersigned by the corporate secretary. The same entity that executes this Response must execute all of the other Response documents, and all security, insurance, bonds and other Contract Documents must be in the name of the entity that executes this Response. Entities desiring to propose as a Joint Venture are cautioned that all documents, including but not limited to the Bid / Proposal Bond must be submitted in the name of the Joint Venture and executed by all members of the Joint Venture.*
Respondent: ________________________________

Respondent’s price for performing the Work pursuant to the Bid / Proposal Documents for the above-referenced project is as set forth on the attached Exhibit A: Price Exhibit.
### EXHIBIT A: PRICE EXHIBIT

**DIVISION 1 - GENERAL REQUIREMENTS**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Primary Section No.</th>
<th>Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01 50 00.00</td>
<td>Mobilization and Demobilization for items required for initiating the project and demobilizing upon completion of the project; Including All Required Permits EXCEPT FOR Batch Plant Mobilization and Associated Clean Air Permit; (see Item 12 - Mobilization for RCC Pavement below)</td>
<td>FP</td>
<td>$__________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>01 50 00.00</td>
<td>Initial Land Survey by RPLS, Prior to Construction (Survey Grid Not More Than Every 100')</td>
<td>FP</td>
<td>$__________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>01 57 23.00</td>
<td>Temporary Storm Water Controls including Reinforced Filter Fabric Barrier, Stabilized Construction Entrance, Concrete Truck Washout Structures, Hydro-mulch Seeding and SW3P requirements per Specification 01 57 23.00, 01 57 13.01, 01 57 14.00, and 01 57 15.00.</td>
<td>FP</td>
<td>$__________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DIVISION 2 - EXISTING CONDITIONS**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Primary Section No.</th>
<th>Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>02 41 13.13</td>
<td>Remove and Dispose or Remove and Stockpile or Relocate All Existing Items Within the Project Work Limits and As Described in Plan Drawings Sheets C-000 through C-006, Including coordination with PHA Construction Manager, Operations and Security, and utility companies or others (as needed).</td>
<td>FP</td>
<td>$__________</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>02 41 13.13</td>
<td>REMOVE ABANDONED CABLES - Locate Both Ends of Abandoned Cable and Remove from Conduit in its Entirety. Unit Price per EACH Manhole.</td>
<td>10</td>
<td>EA</td>
<td>$__________</td>
<td>$__________</td>
</tr>
<tr>
<td>6</td>
<td>02 45 80.00</td>
<td>Temporary Camera Poles (5) Installed and Ready for Panels and Cameras.</td>
<td>FP</td>
<td>$__________</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### EXHIBIT A: PRICE EXHIBIT

**RESPONDENT: ________________________________**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Primary Section No.</th>
<th>Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Amount</th>
</tr>
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<tbody>
<tr>
<td>7</td>
<td>10 46 50.00</td>
<td>Drilled Shaft Foundation for High Mast Light Pole Including Anchor Bolts</td>
<td>8</td>
<td>EA</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>8</td>
<td>26 00 01.05</td>
<td>RE-RACK CABLES - Separate and Route Cables onto Appropriate Racks, Segregating Voltage Classes as needed. Properly Route and Secure Cables to Rack Arms. Refer to Electrical Specifications (Specifically 26 00 01.05 and 26 05 13.16) for Additional Information. Unit Price per EACH Manhole.</td>
<td>26</td>
<td>EA</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>9</td>
<td>26 00 01.05</td>
<td>SEPARATE MIXED VOLTAGE CONDUCTORS - Separate and Route Cables onto Appropriate Racks, Segregating Voltage Classes as needed. Properly Route and Secure Cables to Rack Arms. Refer to Electrical Specifications (Specifically 26 00 01.05 and 26 05 13.16) for Additional Information. Unit Price per EACH Manhole.</td>
<td>15</td>
<td>EA</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>10</td>
<td>26 05 13.16</td>
<td>15KV Copper Medium Voltage Cable and Parallel 3#500MCM + 1#2/0 GND - For the BSS Feeder Loop Extension between BSS-1 and BSS-4</td>
<td>FP</td>
<td></td>
<td>$_________</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>26 05 13.16</td>
<td>INSTALL/REPAIR ARC PROOFING (FIRE TAPE) ON MV CABLES - Install/Repair Arc Proofing (Fire Tape) on MV Cables per Codes and Specifications. Unit Price per EACH Manhole.</td>
<td>15</td>
<td>EA</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>12</td>
<td>26 05 13.16</td>
<td>REPLACE MEDIUM VOLTAGE POWER CABLE SPLICES - Cut and Resplice Medium Voltage Cables to Meet Code and Specification Requirements. Unit Price for all splices within EACH Manhole.</td>
<td>15</td>
<td>EA</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>13</td>
<td>26 05 19.00</td>
<td>REPLACE SECONDARY SPLICES - Cut and Resplice Secondary Cable to Meet Code and Specification Requirements. Unit Price for all splices within EACH Manhole.</td>
<td>10</td>
<td>EA</td>
<td>$_________</td>
<td>$_________</td>
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*Exhibit A: Price Exhibit*  
*CSP Date: April 1, 2014*
<table>
<thead>
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<th>Item No.</th>
<th>Primary Section No.</th>
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<th>Unit Price</th>
<th>Total Amount</th>
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<tbody>
<tr>
<td>14</td>
<td>26 05 26.00</td>
<td>REPAIR GROUNDING - Repair and Replace Grounding Clamps on Racks and Manhole Faces as Required. Unit Price per EACH Manhole.</td>
<td>16</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
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<td>15</td>
<td>26 05 43.00</td>
<td>Underground Conduit Ductbank System w/Ground Conductor, In-Place and Complete Per Plans and Specifications</td>
<td>FP</td>
<td></td>
<td>$____________</td>
<td></td>
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<tr>
<td>16</td>
<td>26 08 00.01</td>
<td>Medium Voltage Commissioning Tests</td>
<td>FP</td>
<td></td>
<td>$____________</td>
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<tr>
<td>17</td>
<td>26 11 16.00</td>
<td>Complete Unitized Transformer Substation for BSS-4 including Vacuum Loop Switch and Breakers, MV and LV Connections per Specification 26 11 16.00, 26 13 19.00 and 26 13 19.01</td>
<td>FP</td>
<td></td>
<td>$____________</td>
<td></td>
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<tr>
<td>18</td>
<td>26 24 16.00</td>
<td>480 Volt Distribution Panels Complete with NEMA 4X Enclosure, Sun Shield, Equipment and Other Associated Devices - For the High Mast Lighting</td>
<td>3</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
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<tr>
<td>19</td>
<td>26 27 16.00</td>
<td>120V Power Enclosure and Communication Enclosure at Base of High Mast Light Pole; Complete with Transformers, Miniature Circuit Breakers, Power Dist. Block and All Other Scheduled Devices; Unit Price per EACH Pole Location (Two Enclosures per EACH location).</td>
<td>8</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
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<tr>
<td>20</td>
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<td>Temporary Camera Enclosures, 1 Per Pole, 120V Power and Communication. Camera Installed and Functioning.</td>
<td>5</td>
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<td>$____________</td>
<td>$____________</td>
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<td>21</td>
<td>26 56 29.00</td>
<td>High Mast Light Standard, Complete Assembly; Less Pole Foundation</td>
<td>8</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
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<td>Item No.</td>
<td>Primary Section No.</td>
<td>Description</td>
<td>Estimated Quantity</td>
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<td>Total Amount</td>
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<td>DIVISION 27 - COMMUNICATIONS</td>
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<tr>
<td>22</td>
<td>27 05 00.00</td>
<td>Provide and install all Single Mode fiber and associated patching, splicing, terminating equipment, and identification labels for a complete fiber optic communication system from the Administration Building to the splice closures and high mast poles as shown on plans and per Specification 27 05 00.00, 27 05 53.00 and 27 13 00.00</td>
<td>FP</td>
<td></td>
<td>$_________</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>27 05 43.00</td>
<td>Provide and install all innerduct conduit in each communications conduit for a complete communication innerduct system as shown in plans and specifications.</td>
<td>FP</td>
<td></td>
<td>$_________</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>27 13 00.00</td>
<td>Provide fiber optic system testing to ANSI and BICSI standards for OTDR and OLTS equipment and submit testing reports as well as all O&amp;M manual submittals as required by plans and specifications.</td>
<td>FP</td>
<td></td>
<td>$_________</td>
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<tr>
<td>DIVISION 31 - EARTHWORK</td>
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<tr>
<td>25</td>
<td>31 05 19.13</td>
<td>Geotextile Fabric for Pavement Section, Associated with Drainage Layer (for RCC Pavement)</td>
<td>98,000</td>
<td>SY</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>26</td>
<td>31 05 19.13</td>
<td>Geotextile Fabric for Pavement Layer Associated with Drainage Layer (for JRC Pavement)</td>
<td>16,700</td>
<td>SY</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>27</td>
<td>31 05 19.13</td>
<td>Geotextile Fabric for Pavement Section, Associated with Drainage Layer (for Blockout Pavement)</td>
<td>1,000</td>
<td>SY</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>28</td>
<td>31 23 13.00</td>
<td>Excavation and Grading As Needed to Achieve the Finished Grades Shown on Plan Drawings C-400 through C-404 Including all Excavation, Borrow Fill, material placement, Topsoil Placement and Hydro-mulch Seeding, and Stockpiling, Including coordination with PHA Construction Manager and others as needed. Such Work Generally Being Shown On Plan Drawings G-009, C-000 through C-006 and per Specification 31 23 13.00, 32 91 19.00 and 32 92 13.01</td>
<td>FP</td>
<td></td>
<td>$_________</td>
<td></td>
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</table>
### Exhibit A: Price Exhibit

<table>
<thead>
<tr>
<th>Item No.</th>
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<th>Total Amount</th>
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<tbody>
<tr>
<td>29</td>
<td>31 23 34.00</td>
<td>14&quot; Fill (for Blockout Pavement)</td>
<td>1,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>30</td>
<td>31 32 14.00</td>
<td>8&quot; Lime-Cement Stabilization of Subgrade Including Lime and Cement (for RCC Pavement)</td>
<td>98,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>31</td>
<td>31 32 14.00</td>
<td>8&quot; Lime-Cement Stabilization of Subgrade Including Lime and Cement (for Blockout Pavement)</td>
<td>1,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>32</td>
<td>31 32 14.00</td>
<td>8&quot; Lime-Cement Stabilization of Subgrade Including Lime and Cement (for JRC Pavement)</td>
<td>16,100</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>33</td>
<td>31 37 16.13</td>
<td>Riprap Gradation No. 1 for Proposed Swales, including Geotextile per Specification 31 37 16.13 and 31 05 19.13</td>
<td>2,100</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>34</td>
<td>31 41 33.01</td>
<td>Trench Safety System (Potable/Fire water) per Specification 31 41 33.01 and 31 41 33.02</td>
<td>3,400</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>35</td>
<td>31 41 33.01</td>
<td>Trench Safety System (Sanitary) per Specification 31 41 33.01 and 31 41 33.02</td>
<td>1,000</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>36</td>
<td>31 41 33.01</td>
<td>Trench Safety System 10 to 15 Feet (Storm) per Specification 31 41 33.01 and 31 41 33.02</td>
<td>800</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>37</td>
<td>31 41 33.01</td>
<td>Trench Safety System 20 to 25 Feet (Storm) per Specification 31 41 33.01 and 31 41 33.02</td>
<td>350</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
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</tbody>
</table>
## EXHIBIT A: PRICE EXHIBIT

RESPONDENT: _________________________________________________________________________________________

<table>
<thead>
<tr>
<th>Item No.</th>
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<th>Unit Price</th>
<th>Total Amount</th>
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</thead>
<tbody>
<tr>
<td>38</td>
<td>32 11 33.00</td>
<td>12&quot; Cement Treated Base Including Emulsified Asphalt Prime Coat (for RCC Pavement) per Specification 32 11 33.00 and 32 12 16.00</td>
<td>98,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>39</td>
<td>32 11 33.00</td>
<td>12&quot; Cement Treated Base Including Emulsified Asphalt Prime Coat (for JRC Pavement) per Specification 32 11 33.00 and 32 12 16.00</td>
<td>15,600</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>40</td>
<td>32 11 33.00</td>
<td>12&quot; Cement Treated Base Including Emulsified Asphalt Prime Coat (for Blockout Pavement) per Specification 32 11 33.00 and 32 12 16.00</td>
<td>1,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>41</td>
<td>32 11 45.00</td>
<td>4&quot; #57 Stone Drainage Layer (for RCC Pavement)</td>
<td>98,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>42</td>
<td>32 11 45.00</td>
<td>4&quot; #57 Stone Drainage Layer Including Core Drain (for JRC Pavement)</td>
<td>16,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>43</td>
<td>32 11 45.00</td>
<td>4&quot; #57 Stone Drainage Layer (for Blockout Pavement)</td>
<td>1,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>44</td>
<td>32 13 13.01</td>
<td>Mobilization for RCC Pavement, Including But Not Limited To, Set-up for Batch Plant, Test Strip and Testing, and Clean Air Permit</td>
<td>FP</td>
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<td>$_________</td>
<td>$___________</td>
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<tr>
<td>45</td>
<td>32 13 13.01</td>
<td>18&quot; Roller Compacted Concrete Pavement</td>
<td>98,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>46</td>
<td>32 13 13.02</td>
<td>18&quot; Jointed Reinforced Concrete Pavement</td>
<td>14,700</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>47</td>
<td>32 13 13.02</td>
<td>4&quot; Lean Concrete (for Blockout Pavement)</td>
<td>1,000</td>
<td>SY</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>48</td>
<td>32 17 23.01</td>
<td>Pavement Marking Stripe (4&quot; White)</td>
<td>2,100</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
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<tr>
<td>49</td>
<td>32 17 23.01</td>
<td>Pavement Marking Stripe (4&quot; Yellow)</td>
<td>40,900</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
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</tbody>
</table>
### Exhibit A: Price Exhibit

**CONSTRUCT CONTAINER YARD 6**
**NORTH AT BAYPORT**

**RESPONDENT:** _________________________________________________________________________________________

<table>
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<tr>
<th>Item No.</th>
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<th>Unit Price</th>
<th>Total Amount</th>
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<tbody>
<tr>
<td>50</td>
<td>32 17 23.01</td>
<td>Pavement Marking Stripe (12&quot; Yellow)</td>
<td>300</td>
<td>LF</td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>51</td>
<td>32 17 23.01</td>
<td>Pavement Marking Stripe (2&quot;x12&quot; Gate Red Stripe”)</td>
<td>50</td>
<td>LF</td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>52</td>
<td>32 17 23.01</td>
<td>Pavement Marking Arrows</td>
<td>40</td>
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<td>$__________</td>
<td>$__________</td>
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<tr>
<td>53</td>
<td>32 17 23.01</td>
<td>Pavement Marking, 6' High Yellow Lettering for Word &quot;STOP&quot;, Per Each Word</td>
<td>30</td>
<td>EA</td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>54</td>
<td>32 17 23.01</td>
<td>Pavement Marking, 20&quot; High Yellow Numerals (Two Numerals Per Each Location); Unit Price Per Each Location</td>
<td>340</td>
<td>EA</td>
<td>$__________</td>
<td>$__________</td>
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<td>55</td>
<td>32 17 23.01</td>
<td>Pavement Marking Letters (3’)</td>
<td>50</td>
<td>EA</td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>56</td>
<td>32 17 23.01</td>
<td>Warning Sign &amp; Buoy</td>
<td>FP</td>
<td></td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>57</td>
<td>32 17 23.01</td>
<td>Concrete Barrier Markings - All Painted Markings on all Concrete Barrier - Numbers and Letters, Regardless of Color and Size (Not Including Concrete Barrier)</td>
<td>FP</td>
<td></td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>58</td>
<td>32 31 13.00</td>
<td>Concrete Barrier (Does NOT Include Concrete Barrier w/Fencing on Top)</td>
<td>4,200</td>
<td>LF</td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>59</td>
<td>32 31 13.00</td>
<td>Double Row Metal Beam Guard Fence and Supports. Unit Price per LF of Double Beam.</td>
<td>50</td>
<td>LF</td>
<td>$__________</td>
<td>$__________</td>
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<tr>
<td>60</td>
<td>32 31 13.00</td>
<td>12&quot; Dia. Concrete Filled Steel Bollard (with Paintings and Markings) and Support</td>
<td>50</td>
<td>EA</td>
<td>$__________</td>
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## EXHIBIT A: PRICE EXHIBIT

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<th>Unit Price</th>
<th>Total Amount</th>
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<tbody>
<tr>
<td>61</td>
<td>32 31 13.00</td>
<td>5' 6&quot; Chain Link Fence with 3-Strand Barbed Wire on Concrete Barrier (Includes Concrete Barrier)</td>
<td>3,000</td>
<td>LF</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>62</td>
<td>32 31 13.00</td>
<td>8' Chain Link Fence with 3-Strand Barbed Wire (On Pavement or on Grade)</td>
<td>100</td>
<td>LF</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>63</td>
<td>32 31 13.00</td>
<td>4' Wide Pedestrian Gate and Supports</td>
<td>1</td>
<td>EA</td>
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**DIVISION 33 - UTILITIES**

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<tr>
<td>64</td>
<td>33 11 13.01</td>
<td>2-1/2 inch Diameter Water Line Stub-Out to the Future Building</td>
<td>15</td>
<td>LF</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>65</td>
<td>33 11 13.01</td>
<td>8-inch Diameter Water Line, by Open-Cut</td>
<td>2,100</td>
<td>LF</td>
<td>$_________</td>
<td>$_________</td>
</tr>
<tr>
<td>66</td>
<td>33 11 13.01</td>
<td>10-inch Diameter Water Line, by Open-Cut</td>
<td>1,100</td>
<td>LF</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>67</td>
<td>33 11 13.04</td>
<td>6-inch Diameter Fire Hydrant Branch, by Open-Cut</td>
<td>300</td>
<td>LF</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>68</td>
<td>33 11 13.04</td>
<td>Fire Hydrant Assembly, All Depths, Including 6-inch Diameter Gate Valve and Box</td>
<td>9</td>
<td>EA</td>
<td>$_________</td>
<td>$_________</td>
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<td>69</td>
<td>33 30 00.00</td>
<td>6-inch Diameter Gravity Sanitary Sewer, by Open Cut</td>
<td>50</td>
<td>LF</td>
<td>$_________</td>
<td>$_________</td>
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<tr>
<td>70</td>
<td>33 30 00.00</td>
<td>8-inch Diameter Gravity Sanitary Sewer, by Open Cut</td>
<td>400</td>
<td>LF</td>
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<td>$_________</td>
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<td>71</td>
<td>33 30 00.00</td>
<td>San. Sewer Manhole</td>
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<td>33 30 00.00</td>
<td>6-inch Diameter Sanitary Sewer Clean Outs Per Each Cleanout (Whether a Single or Double Cleanout)</td>
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<td>EA</td>
<td>$_________</td>
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Exhibit A: Price Exhibit  
CSP Date: April 1, 2014
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Primary Section No.</th>
<th>Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>73</td>
<td>33 32 13.13</td>
<td>Lift Station, Installed Complete In Accordance with Plan Drawings on C-250 and C-251, Including But Not Limited to Valve Boxes, Electrical Pit, Manhole Frames and Covers, Access Hatch, Grates, Trap Drain, Valves and Piping</td>
<td></td>
<td>FP</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>74</td>
<td>33 34 00.00</td>
<td>6-inch Diameter PVC Force Main Sanitary Sewer, by Open-Cut</td>
<td>700</td>
<td>LF</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>75</td>
<td>33 40 00.00</td>
<td>Aircraft Rated Grate (for Exist Storm Junction Box)</td>
<td>1</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>76</td>
<td>33 40 00.00</td>
<td>3' x 21.5' Junction Box Structure (B-1A) Including Airport Rated Manhole Frame and Cover</td>
<td>1</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>77</td>
<td>33 40 00.00</td>
<td>7' x 17.33' Junction Box Structure (B-2), Including Airport Rated Frame and Manhole Cover</td>
<td>1</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>78</td>
<td>33 40 00.00</td>
<td>20'x44' Diversion Structure, Including Airport rated Frame and Manhole Cover and Modification to Existing 54&quot; RCP Storm</td>
<td>1</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>79</td>
<td>33 40 00.00</td>
<td>5' x 8.5' Area Drain Structures, Including Aircraft Rated Frames and Grates</td>
<td>2</td>
<td>EA</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>80</td>
<td>33 40 00.00</td>
<td>18&quot; Concrete Trench Drain Structures, Including Aircraft Rated Covers and Frames</td>
<td>1,650</td>
<td>LF</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>81</td>
<td>33 40 00.00</td>
<td>11-foot by 6-foot Reinforced Concrete Box Storm Sewer, by Open Cut</td>
<td>800</td>
<td>LF</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>82</td>
<td>33 40 00.00</td>
<td>8-foot by 6-foot Reinforced Concrete Box Storm Sewer, by Open Cut</td>
<td>320</td>
<td>LF</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>83</td>
<td>33 40 00.00</td>
<td>6-foot by 8-foot Reinforced Concrete Box Storm Sewer, by Open Cut (at Diversion Structure Outfall)</td>
<td>30</td>
<td>LF</td>
<td>$____________</td>
<td>$____________</td>
</tr>
<tr>
<td>84</td>
<td>33 40 00.00</td>
<td>84&quot; Diameter Ultra Flow CMP (Temp Outfall for Diversion Structure) per Specification 33 40 00.00 and 33 42 13.13</td>
<td>320</td>
<td>LF</td>
<td>$____________</td>
<td>$____________</td>
</tr>
</tbody>
</table>
### EXHIBIT A: PRICE EXHIBIT

**RESPONDENT:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Primary Section No.</th>
<th>Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Price</th>
<th>Total Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>33 40 00.00</td>
<td>4’ x 8'-8” x 10'-8” Concrete Collar</td>
<td>1</td>
<td>EA</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>86</td>
<td>33 42 16.13</td>
<td>24” RCP, by Open Cut</td>
<td>40</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>87</td>
<td>33 42 16.13</td>
<td>36” RCP, by Open Cut</td>
<td>250</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>88</td>
<td>33 42 13.13</td>
<td>42” CMP, by Open Cut</td>
<td>100</td>
<td>LF</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>89</td>
<td>33 71 19.00</td>
<td>Manhole Type &quot;A,B,C,D&quot;; Concrete Manhole Box with Cable Pulling Hook, Conduit Mounting Insert, Cable trays, Including Aircraft Rated Frame &amp; Cover</td>
<td>9</td>
<td>EA</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>90</td>
<td>33 71 19.00</td>
<td>Handhole Type &quot;A,B,C,D&quot;; Concrete Manhole Box with Cable Pulling Hook, Conduit Mounting Insert, Cable Trays, Including Aircraft Rated Frame &amp; Cover</td>
<td>9</td>
<td>EA</td>
<td>$_________</td>
<td>$___________</td>
</tr>
<tr>
<td>91</td>
<td>33 71 19.00</td>
<td>REPLACE RACKS - Install/Replace 2 Vertical Supports and 4 Rack Arms on Each Face of the Manhole. Add Additional Arms if Necessary to Segregate Voltage Classes. Refer to Electrical Specifications for Information Concerning Equipment to be Used. Unit Price per EACH Manhole.</td>
<td>26</td>
<td>EA</td>
<td>$_________</td>
<td>$___________</td>
</tr>
</tbody>
</table>

**TOTAL AMOUNT PROPOSED - Total of Unit Prices Extended**

(For Comparison of Proposals)

$___________________________
(PENALTY OF THIS BOND MUST BE 5% OF THE GREATEST AMOUNT BID/PROPOSED)

KNOW ALL MEN BY THESE PRESENTS:

That, _______________________________________________ (hereinafter called the Principal), as Principal, and
_____________________________________________________ a corporation organized and existing under the
laws of the State of _____________________, with its principal office in the City of _____________________ (hereinafter called the Surety), as Surety, are held and firmly bound unto the Port of Houston Authority, of the State of Texas, in the amount of ______________________________________________________ Dollars ($________________), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE Principal has submitted a proposal for ____________________________________________


NOW, THEREFORE, if the Port of Houston Authority shall accept the proposal of the Principal and Principal shall enter into a contract with the Port of Houston Authority within the time specified in the proposal documents, furnish the Port of Houston Authority proof of the required insurance coverage as set out in the proposal documents and furnish the Port of Houston Authority statutory performance and payment bonds if required by Government Code §2253.001 et.seq., then this obligation shall be null and void, otherwise to remain in full force and effect.

IT IS further agreed by the Principal and the Surety that in the event the Principal shall fail in any of the obligations as set out above, then and in that event the Principal and Surety shall be jointly and severally liable to the Port of Houston Authority for the total amount of this bond as ascertained and liquidated damages by reason of said Principal's failure.

Signed and sealed this ______ day of ______________________, 20___.

________________________________________  _______________________________________
Witness:  Individual or Firm  Principal - Name of Contractor - Typed

________________________________________  _______________________________________
Corporate Secretary - Signature  Principal's Owner or Officer - Signed
(Affix corporate seal here)

_______________________________________
Surety (Typed)

Resident Texas Agent for Service:  By: ________________________________
Name:________________________________________
Address:_____________________________________
Telephone:___________________________________

Attachment 02 – Bid/Proposal Bond  Page 1
Form Revision Date: July 2012
A. **Last Five Projects:** From most recent to least recent, Respondent’s last five (5) projects awarded are as set forth below. For each project, list the: (1) project name, (2) owning entity, contact name and contact information, (3) project description, (4) Respondent’s role on the project (i.e., prime, subcontractor, etc.) and, if other than the Prime, the Respondent’s scope of work and the contract price for Respondent’s scope of work, and (5) project price, award date, and completion date.

1. Project Name: __________________________________________________________

2. Project Owner (Organization/Co., Contact name and Information: ______________

   __________________________________________________________

3. Project Description: ______________________________________________________

4. Respondent’s Role (Prime/Subcontractor), Scope of Work and Contract Price:

   __________________________________________________________

5. Project Price: _________ Award Date: _________ Completion Date: ____________

1. Project Name: __________________________________________________________

2. Project Owner (Organization/Co., Contact name and Information: ______________

   __________________________________________________________

3. Project Description: ______________________________________________________

4. Respondent’s Role (Prime/Subcontractor), Scope of Work and Contract Price:

   __________________________________________________________

5. Project Price: _________ Award Date: _________ Completion Date: ____________
1. Project Name: _________________________________________________________

2. Project Owner (Organization/ Co., Contact name and Information: _____________________________

   _____________________________________________

3. Project Description: _____________________________

   _____________________________________________

4. Respondent’s Role (Prime/ Subcontractor), Scope of Work and Contract Price:

   _____________________________________________

5. Project Price: __________ Award Date: __________ Completion Date: __________

1. Project Name: _________________________________________________________

2. Project Owner (Organization/ Co., Contact name and Information: _____________________________

   _____________________________________________

3. Project Description: _____________________________

   _____________________________________________

4. Respondent’s Role (Prime/ Subcontractor), Scope of Work and Contract Price:

   _____________________________________________

5. Project Price: __________ Award Date: __________ Completion Date: __________

1. Project Name: _________________________________________________________

2. Project Owner (Organization/ Co., Contact name and Information: _____________________________

   _____________________________________________

3. Project Description: _____________________________

   _____________________________________________

4. Respondent’s Role (Prime/ Subcontractor), Scope of Work and Contract Price:

   _____________________________________________

5. Project Price: __________ Award Date: __________ Completion Date: __________
B. **Additional Experience:** Respondent shall list any additional relevant experience of Respondent in the space below. If Respondent needs additional space, additional pages may be attached. Respondent shall label any additional pages “ATTACHMENT 03 – PROJECT EXPERIENCE” and state the name of this project. For each relevant project list: (1) project name, (2) project description, (3) project owner, including the name of the owner, contact at the owner, and contact information for the contact, (4) project price, (5) award date, and (6) project completion date.

________________________________________________________________________

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ATTACHMENT 04 – PROFESSIONAL REFERENCES FORM

Respondent:

Respondent shall list any professional references for Respondent in the space below. If Respondent needs additional space, additional pages may be attached. Respondent shall label any additional pages "ATTACHMENT 04 – PROFESSIONAL REFERENCES" and state the name of this project. For each reference, please provide (1) the individual's name, (2) the individual's contact information, including telephone number and email address, and (3) an explanation of the relationship of Respondent to the reference.

Reference 1:

Name:

Contact Information:

Relationship:

Reference 2:

Name:

Contact Information:

Relationship:

Reference 3:

Name:

Contact Information:

Relationship:
ATTACHMENT 05 – SAFETY RECORD DATA FORM

Respondent: ________________________________

Pursuant to Texas Water Code Section 60.4115, the Port Authority requires the Respondent to supply information regarding the safety and environmental record of Respondent pursuant to this Safety Record Data Form. Respondent should be aware that its failure to comply with the requirements of Texas Water Code Section 60.4115 may result in termination of any contract awarded.

1. Has the Respondent, or an entity related to the Respondent, had any fatalities occurred to any employee or subcontractor employee on any project within the last ten (10) years?  
   Check one:  
   ☐ Yes (attach an explanation of the circumstances)  
   ☐ No

2. Has the Respondent, or an entity related to the Respondent, been cited by OSHA within the last ten (10) years?  
   Check one:  
   ☐ Yes (attach an explanation of the circumstances)  
   ☐ No

Note: For questions 1. and 2., an “entity related to Respondent” refers to any entity, its principals and management officers, that is or has controlled, or is or has been controlled by or under common control with the Respondent.

3. Year that company was established: ________________

4. Respondent’s Standard Industrial Classification (“SIC”), or North American Industry Classification System (“NAICS”), code that applies to a major portion of work in the project: ______________.

5. Respondent’s Injury Incident Rate (“IIR”) as calculated by the formula shown below as established by the U.S. Department of Labor Bureau of Labor Statistics, and related data for each of the last five (5) calendar years:

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Total No. of Injuries/ Incidents reported</th>
<th>Annual Average Number of Employees</th>
<th>Total Hrs. Worked by All Employees</th>
<th>Injury-Incident Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

*Injury-Incident Rate = (Number of Injuries x 200,000) / Total Hrs. Worked by all Employees

6. If Respondent is not reporting an “IIR” for any year, please explain:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
7. Respondent’s Workers Compensation Experience Modification Rate (“EMR”) for each of the last five (5) calendar years, as provided by the Respondent’s Insurance agent:

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>EMR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. If Respondent is not reporting an “EMR” for any year, please explain:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Respondent: ________________________________________________________________

Respondent shall check “Yes” or “No” to the questions below as they apply to the Respondent or an entity related to Respondent. “Entity related to Respondent” means any entity, its principals and management officers that is or has controlled, or is or has been controlled by or under common control with the Respondent.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
| ☐   | ☐  | 1. Has Respondent been disqualified or disallowed from bidding on a project for any public entity or otherwise determined to be unfit, unsuitable, unqualified, or not a responsible bidder for such a project, in the last five (5) years? (A “public entity” means the United States of America or any state, county, municipality or other governmental or political subdivision within the United States of America.)

| ☐ | ☐ | 2. Has any warranty or defective workmanship claim been asserted against Respondent, or its work or services, in the last five (5) years?

| ☐ | ☐ | 3. Has Respondent been declared in default under a project, been terminated for cause from a project, abandoned a project, or otherwise failed to complete a project in the last five (5) years?

| ☐ | ☐ | 4. Has a surety for Respondent been required to perform on Respondent’s behalf, under the performance bond for a project, in the last five (5) years?

| ☐ | ☐ | 5. Has Respondent had its license(s) required to perform the work suspended or terminated in the last five (5) years?

| ☐ | ☐ | 6. Has Respondent been a plaintiff, defendant or other party to any litigation, arbitration, mediation or other claim resolution procedure regarding its business in the last five (5) years?

| ☐ | ☐ | 7. Has Respondent ever declared bankruptcy, been the subject of an involuntary bankruptcy proceeding, made an assignment for the benefit of creditors, been subjected to receivership proceedings in any court, or determined to be insolvent?

| ☐ | ☐ | 8. Has Respondent, its owner or operator ever been convicted of a felony?

For all questions to which the Respondent answered “Yes,” provide an explanation in the space below or on an attached separate sheet. Respondent shall label any additional pages “ATTACHMENT 06 – BACKGROUND INFORMATION” and state the name of this project.
## ATTACHMENT 07 – WORK BREAKDOWN FORM

**CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL**

### Contractor/Supplier Name
<table>
<thead>
<tr>
<th>Address</th>
<th>Telephone</th>
<th>Work to be performed</th>
<th>Dollar Amount</th>
<th>Small Bus.? (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prime Contractor</strong>(^{(1)})</td>
<td></td>
<td>Self-performed field work</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All other work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Subcontractor/Supplier Name
<table>
<thead>
<tr>
<th>Address</th>
<th>Telephone</th>
<th>Work to be performed</th>
<th>Dollar Amount - excl. mark-up (^{(2)})</th>
<th>Dollar Amount - incl. mark-up (^{(3)})</th>
<th>Small Bus. (^{(4)})</th>
</tr>
</thead>
</table>

---

\(^{(1)}\) Prime Contractor (1) Self-performed field work

\(^{(2)}\) Dollar Amount - excl. mark-up

\(^{(3)}\) Dollar Amount - incl. mark-up

\(^{(4)}\) Small Bus.?
## ATTACHMENT 07 – WORK BREAKDOWN FORM

<table>
<thead>
<tr>
<th>Subcontractor/ Supplier Name</th>
<th>Address</th>
<th>Telephone</th>
<th>Work to be performed</th>
<th>Dollar Amount - excl. mark-up (2)</th>
<th>Dollar Amount - incl. mark-up (3)</th>
<th>Small Bus. % (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

### Notes:

1. The Contractor must perform at least twenty-five percent (25%) of the total dollar value of the portion of the Contract Price attributable to the Work performed in the field with its Own Forces, unless the Special Conditions state otherwise.

2. Dollar value of work **NOT including** Prime Contractor mark-up or proportionate share of Prime Contractor’s overhead & profit

3. Dollar value of work **including** Prime Contractor mark-up or proportionate share of Prime Contractor’s overhead & profit

4. A fully executed Letter of Intent MUST be submitted for each Small Business subcontractor or supplier listed. All small business subcontractor changes must be approved by both the Vice President Small Business Development Division and the Managing Director Engineering and Construction. Reference may be made to Respondent’s Work Breakdown Form for ease in identification of small business subcontractors. For each small business, note the percentage of the total price **NOT including** the Prime Contractor mark-up or proportionate share of Prime Contractor’s overhead & profit being performed by that small business.

5. The Total Price **including** include mark-up must add to total amount on Price Form

6. The Total Subcontract Amount is **NOT including** Price contractor mark-up or proportionate share of Prime Contractor’s overhead & profit
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

ATTACHMENT 08 – SMALL BUSINESS PLAN

Respondent:___________________________________________________

Small Business Liaison (name & number):_________________________________________________________

_____________________________________________________________________________________________

Total PHA Approved Small Business Subcontract Amount: $_____________________________

This amount should match the amount set forth on Respondent’s Work Breakdown Form for the amount
subcontracted to small businesses, excluding Respondent’s mark-up or proportionate share of the
Respondent’s overhead profit.

Total PHA Approved Small Business Committed Percentage: 35%

This amount should match the percentage set forth on Respondent’s Work Breakdown Form for the amount
subcontracted to small businesses, NOT INCLUDING Respondent’s mark-up or proportionate share of the
Respondent’s overhead and profit.

Small Business Participation Contract Goal: 35% as listed on Page 2 of the Request for Competitive Sealed
Bids / Proposals for the Project.
LETTER OF INTENT
PORT OF HOUSTON AUTHORITY
111 East Loop North, Houston, Texas 77029-4326
Telephone: (713) 670-2597 / Fax: (713) 670-2498
Email: smallbusiness@poha.com

Project Name and Number: ____________________________________________________________

Small Business Participation Contract Goal (%): ____________________________

Upon award of the contract, the undersigned firms agree to execute a subcontract agreement for the scope of services listed below. ________________________________________________________________________________ agrees to provide the following goods/services in relationship to the above referenced project to ____________________________________________________________________________.

Scope of Services: ________________________________________________________________________________

__________________________________________________________________________________________

Subcontract Amount ($) : ___________________ Percent of Participation Goal (%): ________________

Prime Contractor/Vendor

Name of Company

Address

City/State Zip

Telephone Number

Fax Number

Name of Officer (Print or Type)

Signature of Officer

Date

PHA Approved Small Business/Supplier

Name of Company

Address

City/State Zip

Telephone Number

Fax Number

Name of Officer (Print or Type)

Signature of Officer

Date

*Small business credit may be obtained only on specific work done for the project, supply of labor, supply of equipment specifically for physical work on the project or supply of materials to be incorporated in the work. Small business credit will not be allowed for cost such as overhead items, capital expenditures (for example, purchase of equipment), and office items.

*PHA will count toward the applicable small business goals only expenditures to SBDP-Certified Prime Contractors or SBDP-Certified first-tier subcontractors (subcontractors who contract directly with the Prime Contractor). Expenditures to subcontractors below the first-tier subcontract level will not be counted toward applicable small business goals.
STATEMENT OF GOOD FAITH EFFORT

PORT OF HOUSTON AUTHORITY
P.O. Box 2562, Houston, Texas  77252-2562
Telephone: (713) 670-2597 / Fax: (713) 670-2498
Email: smallbusiness@poha.com

Project Name and Number: ___________________________________________________________

☐ Prime Contractor/Vendor is unable to meet the Small Business Participation Goal set at _____%,
however will be achieving _____% of the participation goal. (provide explanation below)

☐ Prime Contractor/Vendor is requesting a waiver from the Small Business Participation Goal set at
_______% and have met the minimum standards for “Good Faith Effort”. (provide explanation below)

GOOD FAITH EFFORT MINIMUM STANDARDS (please provide proof of the following)

☐ Delivery of written notice of subcontracting opportunities to the appropriate and industry-specific small
businesses identified by Small Business Development and to any small business that requests
information regarding the above referenced project

☐ Utilization of local small business and minority- and women-focused associations for notice purposes
regarding subcontracting opportunities

☐ Written notices containing the following:

(i) Adequate information about the plans, specifications, and relevant terms and conditions of the contract
and about the work to be subcontracted to, or the goods to be obtained from, subcontractors and
suppliers;

(ii) A contact person with the proposer’s office to answer questions;

(iii) Information regarding the proposer’s bonding requirements, the procedure for obtaining any needed
bond, and the name and telephone number of one or more acceptable surety companies to contact;
and

(iv) The last date for receipt by the proposer of small business price quotations;

☐ Compliance with the dispute resolution provisions of the SBDP; and Adhering to PHA’s
Nondiscrimination Mandate in the procurement and discharge of an SBDP-eligible contract and the
performance of the SBDP requirements

The vendor attests that a “Good Faith Effort” has been made to identify and use small businesses in reaching
PHA’s Small Business Participation goal and that supporting documentation will be provided.

Signature ___________________________ Date ___________________________

Printed Name _________________________ Name of Company ___________________________
Article VI, Section D of the Port Authority’s Code of Ethics provides that the Port Authority must receive specific approval from the Port Commission before entering into any contract (other than a contract subject to competitive bids) with any Person, Business or Business Affiliate (as defined in the Code of Ethics, available at http://www.portofhouston.com/inside-the-port-authority/policies-and-procedures/) employing or represented by a Person, who has been, within the preceding 12-month period, an employee of the Port Authority, if the contract relates to a matter for which the employee had responsibility while representing the Port Authority.

In order to ensure compliance with the Code of Ethics, Respondent must provide a list, in the space below, of the names of:

1. Any employees of Respondent (or any of Respondent’s parents, subsidiaries, sister companies, contractors, subcontractors, or other affiliates) who have been, within the preceding 12-month period (calculated from the date of Respondent’s RFQ Response), an employee of the Port Authority; and

2. Any other representatives of Respondent who will be performing work on this project and who have been, within the preceding 12-month period, an employee of the Port Authority.
KNOW ALL MEN BY THESE PRESENTS:

That, ________________________________ (hereinafter called the Principal),  as Principal, and ________________________________________________________, a corporation organized and existing under the laws of the State of __________________________, with its principal office in the City of __________________________ (hereinafter called the Surety), as Surety, are held and firmly bound unto the Port of Houston Authority, of the State of Texas, (hereinafter called the Obligee) in the amount of _________________________________________________________________ Dollars ($________________), for the payment whereof, the executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE Principal has entered into a certain written contract with the Obligee, dated the _____ day of __________________________, 20___, to ________________________________________________________________

which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Texas Government Code Sec. 2253.001 et seq. of the Revised Civil Statutes of Texas as amended, and all liabilities on this bond to all such claimants shall be determined in accordance with the provisions of said Code to the same extent as if it were copied at length herein.

SURETY, FOR VALUE RECEIVED, stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to work performed thereunder, or to the plans, specifications or drawings accompanying same, shall in any way affect its obligations on this bond and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder.

IN WITNESS WHEREOF, of said Principal and Surety have signed and sealed this instrument this ________ day of __________________________, 20____.

Witness: Individual or Firm                  Principal – Name of Contractor – Typed

________________________________________ ____________________________________
Corporate Secretary – Signature                  Principal’s Owner or Officer – Signed

________________________________________
Surety – Typed

By: ____________________________________
   Attorney-in-Fact
   (Power of Attorney must be attached hereto)

PORT OF HOUSTON AUTHORITY

Approved ___________________ 20___

By ___________________________ Name: ___________________________
   Director, Project & Construction Management

Approved as to form: Address: ___________________________

________________________________________ Telephone: __________________________
Counsel

The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Department of Insurance by calling the following toll free number: 1-800-578-4677.
KNOW ALL MEN BY THESE PRESENTS:

That, _______________________________ (hereinafter called the Principal), as Principal, and
__________________________________, a corporation organized and existing under the laws of the State of
__________________________, with its principal office in the City of ______________________ (hereinafter called the Surety), as
Surety, are held and firmly bound unto the Port of Houston Authority, of the State of Texas, (hereinafter called the
Obligee) in the amount of ____________________________ Dollars ($______________), for the payment whereof, the executors, successors and assigns, jointly and severally,
firmly by these presents.

WHEREAS, THE Principal has entered into a certain written contract with the Obligee, dated the _____ day of
_______________, 20___, to construct _____________________________________which is hereby referred to
and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all
claimants supplying labor and material to him or a subcontractor in the prosecution of the work provided for in said
contract, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Texas Government Code Sec.
2253.001 et seq. of the Revised Civil Statutes of Texas amended, and all liabilities on this bond to all such
claimants shall be determined in accordance with the provisions of said Code to the same extent as if it were
copied at length herein.

SURETY, FOR VALUE RECEIVED, stipulates and agrees that no change, extension of time, alteration or
addition to the terms of the contract or to work performed thereunder, or to the plans, specifications or drawings
accompanying same, shall in any way affect its obligations on this bond and it does hereby waive notice of any
such change, extension of time, alteration or addition to the terms of the contract or to the work to be performed
thereunder.

IN WITNESS WHEREOF, of said Principal and Surety have signed and sealed this instrument this ________
day of __________________________, 20____.

Witness: Individual or Firm                      Principal – Name of Contractor – Typed

Corporate Secretary – Signature                      Principal’s Owner or Officer – Signed

Surety – Typed

By: ____________________________________________
    Attorney-in-Fact
    (Power of Attorney must be attached hereto)

PORT OF HOUSTON AUTHORITY

Approved __________________, 20____             Resident Texas Agent for service:

By______________________________________ Name: ______________________________

Director, Project & Construction Management

Approved as to form:                                  Address: __________________________

Counsel                                         Telephone: __________________________

The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Department of Insurance by
calling the following toll free number: 1-800-578-4677.

Payment Bond
Form Revision Date: September 2013

Page 1
PORT OF HOUSTON AUTHORITY to perform the Work and to furnish all services, labor, materials, supplies, equipment, insurance and incidentals necessary to complete the Work, pursuant to this Contract dated the ___ day of ___________ 20__, in strict conformity with all Contract Documents prepared by or for the Port of Houston Authority for the following project scope: CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL (“Site”). The Contractor represents and warrants to the Port of Houston Authority that it has carefully examined this Contract and all other Contract Documents which are made a part of the Contract and is thoroughly familiar therewith, including:

a) Port of Houston Authority Long Form General Conditions for Construction Work on Port of Houston Authority Property dated APRIL 1, 2014;
b) Special Conditions for CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL dated APRIL 1, 2014, and exhibits thereto;
c) Technical Specifications for CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL dated APRIL 1, 2014;
d) [other? Be sure to list any attached exhibits or other special documents for incorporation]

And including any amendments thereto by Addenda ____ through ____.

The Port of Houston Authority agrees to pay to the Contractor for the obligations of this Contract the estimated sum of _____________________________________________________ ($___________) in accordance with the terms and conditions of the Contract Documents. The Contract Time to perform this Contract is _____ calendar days from Notice to Proceed [or Completion date for this Contract: ____].

_______________________________________  
CONTRACTOR

Corporate Secretary  

By:  
Signature - Signed

Witness (Non-Corporate Entity)

_______________________________________  

By:  
Signature - Typed

Title of Signer

APPROVED AS TO CONTENT:

_______________________________________  
PORT OF HOUSTON AUTHORITY

Port Construction Representative  

By:  
Director, Project & Construction Management
APPROVED AS TO FORM:

Port Authority Counsel

I certify funds are or will be available to meet the obligation of this Contract when due.

This Contract approved at Commission Meeting of ____________, 20__, by Minute Number ____________.

Port Authority Financial Services

By: ________________________________
Date: ______________________________

____________________________________
Port Authority Counsel

____________________________________
Port Authority Financial Services
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LONG FORM GENERAL CONDITIONS
FOR CONSTRUCTION WORK ON PORT OF HOUSTON AUTHORITY PROPERTY

SECTION 1. DEFINITIONS OF TERMS

Whenever in these General Conditions and in the other Contract Documents, the following terms are used, the intent and meaning shall be interpreted as set out below.

1.01 Addenda:

“Addenda” are the documents issued by the Port of Houston Authority after the initial Bid/Proposal Request has been issued to bidders/proposers and prior to the acceptance of bids/proposals.

1.02 Applicable Law:

“Applicable Law” means any and all federal, state and local statutes, laws, rules, regulations, ordinances, codes and rules of common law pertaining to the Contractor’s services, the Site, the Contractor’s employees and Subcontractor’s employees and/or the Work, including, without limitation (i) Environmental Laws, (ii) those pertaining to equal opportunity, affirmative action and discrimination, (iii) those pertaining to health or safety, and (iv) those pertaining to immigration.

1.03 Baseline Schedule:

“Baseline Schedule” shall have the meaning set forth in Section 6.04(a).

1.04 Bid/Proposal:

The “Bid/Proposal” is the Contractor’s bid or proposal submitted in connection with the Work, as such bid or proposal may be modified and agreed to or ordered, in each case, in writing, by the Port of Houston Authority.

1.05 Bid/Proposal Request:

The “Bid/Proposal Request” are those documents issued by the Port of Houston Authority soliciting bids/proposals, including any Addenda.

1.06 Bonds:

The “Bonds” are the performance and payment bonds that the Contractor is required to furnish to the Port of Houston Authority pursuant to Section 2.09.

1.07 Change:

The term “Change” means any change, modification, adjustment, revision, addition to, deletion from or alteration in the Work or the terms of any Contract Document, including, without limitation, the Contract Price or Contract Time.
1.08 **Change Orders**:  
A “Change Order” is a written document agreed to and executed by the Port of Houston Authority and Contractor after Contract execution and in accordance with the Contract Documents setting forth a Change.

1.09 **Change Proposal**:  
“Change Proposal” shall have the meaning set forth in Section 8.04.

1.10 **Claim**:  
A “Claim” is a claim, demand or assertion by the Contractor seeking for itself or on behalf of a Subcontractor or Supplier: adjustment or interpretation of any Contract term, including without limitation, adjustment of the Contract Price or Contract Time; payment of money; relief from obligations; or other relief or recovery with respect to the terms of the Contract. The term “Claim” also includes other disputes and matters in question asserted by the Contractor (whether for itself or on behalf of a Subcontractor or Supplier) arising out of or relating to the Contract.

1.11 **Concurrent Delay**:  
“Concurrent Delay” is a delay to any activity caused in whole or in part, or contributed to by any primary, concurrent or contributorily negligent acts or omissions by the Contractor, its Subcontractors or Suppliers, or which arises from any other failure by Contractor or its Subcontractors or Suppliers to perform their respective obligations in accordance with the Contract Documents. A Concurrent Delay remains a Concurrent Delay even though the Port of Houston Authority or any of the Port of Houston Authority’s other contractors or any other persons or entities for which the Port of Houston Authority is responsible are concurrently or contributorily negligent or otherwise the cause of delay to the work.

1.12 **Construction Change Directive**:  
A “Construction Change Directive” is a document issued and signed by the Port Contract Representative directing the Contractor to make a minor Change in the Work, which Change shall not require any modification of the Contract Price.

1.13 **Construction Manager**:  
“Construction Manager” shall mean the person designated as such for the Project by the Port Construction Representative. The Port Construction Representative may change the Construction Manager from time to time by notice to the Contractor.

1.14 **Contract and Contract Documents**:  
The “Contract Documents” are composed of the Contract agreement signed by the Port of Houston Authority and Contractor, these General Conditions, Special Conditions, Specifications and Drawings, the Purchase Order, and Modifications. The Contract Documents form the “Contract”.

1.15 **Contract Price**:  
The “Contract Price” is the amount set forth in the Contract agreement, as such amount may be modified by Change Order, which the Contractor is entitled to receive for full, complete and timely performance of the Work in accordance with the Contract Documents.
1.16 **Contract Time:**

The “Contract Time” is the time period set forth in the Contract for the Contractor to substantially complete the Work. The Contract Time may be expressed in number of calendar days or number of Working Days or by reference to the date of Substantial Completion. If the Contract Time is measured by calendar days, each and every calendar day shall be counted against the Contract Time. If the Contract Time is measured by Working Days, Saturdays, Sundays and Associated General Contractors of America (“AGC”) holidays shall not be counted against the Contract Time. If the Contract Time is measured by calendar days or Working Days, the measurement shall be made from the Start Work Date.

1.17 **Contractor:**

A “Contractor” means the independent contractor which is named in the Contract agreement and is responsible for the Work.

1.18 **Contractor Proprietary Information:**

“Contractor Proprietary Information” shall have the meaning set forth in Section 2.05.

1.19 **Day or day:**

“Day” or “day” means calendar day.

1.20 **Design Consultant:**

“Design Consultant” means an independent architect or engineer with responsibility for design of the Work. The Design Consultant is an independent contractor and not an employee or agent of the Port of Houston Authority.

1.21 **Drawings:**

The “Drawings” are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, which Contract Documents may include without limitation plans, views, elevations, sections, details, schedules or diagrams.

1.22 **Environmental Laws:**

“Environmental Laws” means any and all applicable federal, state or local statutes, laws, rules, regulations, ordinances, codes and rules of common law now in effect and any current judicial or administrative interpretation thereof, including any judicial or administrative order, consent decree, or judgment, relating to pollution or protection of human health, natural resources or the environment, Releases or threatened Releases of Hazardous Substances, or generation, manufacture, processing, distribution, use, treatment, storage, handling, transport or disposal, or arrangement for transport or disposal of, or exposure to, Hazardous Substances. Without limiting the foregoing, Environmental Laws includes the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§ 9601, et seq.; the Hazardous Materials Transportation Law, 49 U.S.C. §§ 5101, et seq.; the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901, et seq.; the Federal Water Pollution Control Act, 33 U.S.C. §§ 1201, et seq.; the Toxic Substances Control Act, 15 U.S.C. §§ 2601, et seq.; the Clean Air Act, 42 U.S.C. §§ 7401, et seq.; the Safe Drinking Water Act, 42 U.S.C. §§ 300f, et seq., the Federal Insecticide, Fungicide, and Rotenecide Act, 7 U.S.C. §§ 136, et seq.; and the Occupational Safety and Health Act, 29 U.S.C. §§ 651, et seq., as each has been amended from time to time and is now in effect, and all other environmental conservation and protection laws, in each case as has been amended from time to time and is now in effect.
1.23 **Equipment and Materials:**

"Equipment and Materials" means the equipment, materials, supplies, systems, implements, tools, appliances and other installations to be supplied or supplied by the Contractor, its Subcontractors and Suppliers, whether incorporated or otherwise used in connection with the Work.

1.24 **Field Supervisor:**

"Field Supervisor" shall have the meaning set forth in Section 4.27.

1.25 **Final Completion:**

"Final Completion" shall have the meaning set forth in Section 6.12.

1.26 **Force Majeure:**

The term "Force Majeure" shall have the meaning set forth in Section 6.15.

1.27 **Governmental Authority:**

"Governmental Authority" means (a) the United States of America or any foreign country, (b) any state, county, municipality or other governmental subdivision within the United States of America or any foreign country, and (c) any court or any governmental department, commission, board, bureau, agency or any governmental subdivision of the United States of America or any foreign country, or of any state, county, municipality or other governmental subdivision within the United States of America or any foreign country.

1.28 **INTENTIONALLY OMITTED**

1.29 **Hazardous Substances:**

"Hazardous Substances" means:

(i) any chemical, product, material, substance or waste defined as or included in the definition of "hazardous material," "hazardous waste," "hazardous substance," "extremely hazardous substance," "toxic substance," "solid waste," "toxic waste," "restricted hazardous waste," "contaminant," "pollutant," and "toxic pollutant" or words of similar meaning or import found in any Environmental Law;

(ii) any asbestos or any material which contains any hydrated mineral silicate, including chrysotile, amosite, crocidolite, tremolite, anthophyllite and/or actinolite, whether friable or non-friable;

(iii) any polychlorinated biphenyls ("PCBs"), or PCB-containing materials or fluids;

(iv) radon;

(v) any other hazardous, radioactive, toxic or noxious substance, material, pollutant, or solid, liquid or gaseous waste;

(vi) any pollutant or contaminant (including petroleum, petroleum hydrocarbons, petroleum products, petroleum substances, crude oil or any fraction or derivative thereof, any oil or gas exploration or production waste, any natural gas, synthetic gas, manufactured gas or
any mixture thereof) which in its condition, concentration or area of Release could have a
significant effect on human health, the environment, or natural resources;

(vii) any substance that, whether by its nature or its use, is subject to regulation or may result
in liability under any Environmental Law or with respect to which any Environmental Law
or Governmental Authority requires environmental investigation, monitoring or
remediation; and

(viii) any underground storage tanks, as defined in 42 U.S.C. Section 6991(1)(A)(I) (including
those defined by Section 9001(1) of the 1984 Hazardous and Solid Waste Amendments
to the Resource Conservation and Recovery Act, 42 U.S.C. Section 6901 et seq.; the
Texas Water Code Annotated Section 26.344; and Title 30, Chapter 334 of the Texas
Administrative Code), whether empty, filled or partially filled with any substance.

1.30 Inspectors:

The “Inspectors” are the individuals assigned by the Port Construction Representative (which
individuals may be third party contractors) to make inspections and observations of any or all portions of
the Work and Equipment and Materials associated with the Contract and Contractor’s performance of the
Contract.

1.31 Insurance Certificates:

The “Insurance Certificates” shall mean the proof of insurance that the Contractor is required to
furnish to the Port of Houston Authority pursuant to the Contract Documents.

1.32 Intellectual Property Rights:

"Intellectual Property Rights" shall mean: (a) all software, source code and object code, and
modifications (including software under development), ideas and discoveries and inventions (whether or
not patentable), trade secrets, information (confidential or otherwise), technical data, techniques,
processes, methods, plans, designs, drawings, schematics, specifications, communications protocols,
test procedures, algorithms, technology, know-how, customer lists, marketing and customer information,
documentation, materials and works of authorship which are the subject matter of copyright, regardless of
how embodied; and (b) all intangible intellectual property rights therein, including the right to make, sell,
license or otherwise distribute, and use, and any and all applications for United States or foreign patents
or issued patents; all trademarks, service marks, trade names, or trade dress, and all pending or issued
United States or foreign registrations thereof; and copyrights and United States and foreign applications
and registrations thereof, including the rights to copy, sell, license or otherwise distribute, display, publish
and create derivative works therefrom.

1.33 Knowledge / Recognize / Discover:

The term “knowledge,” “recognize,” and “discover,” their respective derivatives and similar terms
in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that
which the Contractor knows, recognizes and discovers. The term “should know,” “should recognize” or
“should discover” and their respective derivatives and similar terms in the Contract Documents, as used in
reference to the Contractor, shall mean that which the Contractor should know, recognize or discover in
the exercise of the Standard of Care required by the Contract Documents. Analogously, the expressions
“inferable”, “reasonably inferable” and similar terms in the Contract Documents shall be interpreted to
mean reasonably inferable by a contractor familiar with the Project and exercising the Standard of Care
required of the Contractor by the Contract Documents.
1.34 **Limits of Construction:**

The term "limits of construction" as identified throughout the Contract Documents shall be the physical limit of construction that will constitute the completed Work at ground surface level. The limits of Work required to construct the Project to the limits of construction may be required to extend beyond the limits of construction and into separate contractor’s sites and vice versa. In some instances, utilities and earthwork may be required to extend underground beyond the limits of construction to accommodate existing Site conditions or requirements in the drainage swales.

1.35 **Losses:**

The term “Losses” shall have the meaning set forth in Section 11.08.

1.36 **Milestone:**

The term “Milestone” means separately stated time(s), if any, set forth in the Special Conditions and any Modifications for Substantial Completion of specified portions of the Work.

1.37 **Modification:**

A “Modification” is (1) a written amendment to the Contract signed by both the Contractor and the Port of Houston Authority, (2) a Change Order, (3) a Construction Change Directive, or (4) a written interpretation of the Contract Documents issued by the Port Contract Representative. The Contract may be amended or modified only by a Modification.

1.38 **MOSS:**

“MOSS” shall have the meaning set forth in Section 4.10(g).

1.39 **Notice to Proceed:**

The term “Notice to Proceed” shall have the meaning set forth in Section 6.01.

1.40 **Own Forces:**

“Own Forces” means actual field labor performed at the Site by Contractor’s employees under the immediate supervision of Contractor’s Field Supervisor. By way of example only, the following is not Work performed by Contractor’s Own Forces:

a. Work performed by Subcontractors or contract laborers; or

b. Work performed in the Contractor’s office or anywhere other than in the field at the Site, even if performed by the Contractor’s employees.
1.41 **Port Contract Representative:**

The “Port Contract Representative” is the individual designated as such in or pursuant to the Special Conditions.

1.42 **Port Construction Representative:**

The “Port Construction Representative” is the individual designated as such in or pursuant to the Special Conditions.

1.43 **Port of Houston Authority:**

The Port of Houston Authority of Harris County, Texas is a political subdivision of the State of Texas and a body politic. The terms “Port,” “Port of Houston Authority” and “Port Authority” are synonymous with the Port of Houston Authority of Harris County, Texas. The Port Authority is independent and not a part of the government of Harris County, Texas or the City of Houston.

1.44 **Port of Houston Authority Commission or Commission:**

“Port of Houston Authority Commission”, “Port Commission” or “Commission” refers to the Port of Houston Authority Commission which governs the Port of Houston Authority. The commission meets monthly and is comprised of a chairman and six commissioners. The Commission is the ultimate governing authority of all Port of Houston Authority operations.

1.45 **Port of Houston Authority Indemnitees:**

The “Port of Houston Authority Indemnitees” means the Port of Houston Authority and its Commissioners, directors, officers, agents and employees.

1.46 **Product Data:**

“Product Data” means manufacturers’ standard schematic drawings, catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, Material Safety Data Sheets (MSDS) or any other descriptive items.

1.47 **Progress Schedule:**

“Progress Schedule” shall have the meaning set forth in Section 6.05.

1.48 **Project:**

The “Project” is the total Port of Houston Authority construction project of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Port of Houston Authority or by separate contractors.

1.49 **Purchase Order:**

The “Purchase Order” is the written and fully executed purchase order covering the Work and issued to the Contractor in accordance with the Contract Documents.

1.50 **Purchasing Manager:**

The “Purchasing Manager” is the purchasing manager of the Port of Houston Authority.
1.51 **Release:**

“Release” means any depositing, spilling, leaking, pumping, pouring, placing, emitting, discarding, abandoning, emptying, discharging, migrating, injecting, escaping, leaching, dumping, or disposing.

1.52 **Request for Information or RFI:**

“Request for Information” or “RFI” means written request from the Contractor to the Port Construction Representative requesting information in respect of, an interpretation of, or direction with respect to a requirement or provision of the Contract Documents. Neither an RFI nor a response to an RFI is a Contract Document.

1.53 **Revised Baseline Schedule:**

“Revised Baseline Schedule” shall have the meaning set forth in Section 6.04(b).

1.54 **Samples:**

“Samples” are physical examples which illustrate Equipment and Materials or workmanship and establish standards by which the Work will be judged.

1.55 **Schedule of Costs:**

“Schedule of Costs” shall have the meaning set forth in Section 10.01.

1.56 **Schedule of Submittals:**

“Schedule of Submittals” shall have the meaning set forth in Section 4.10(b).

1.57 **Shop Drawings:**

“Shop Drawings” are drawings, diagrams, schedules and other data specially provided for the Work by the Contractor, its Subcontractors or Suppliers to illustrate how certain specific Work components fit together and will be located in relation to each other.

1.58 **Site:**

The “Site” is the physical location of the Project identified as such in the Contract agreement.

1.59 **Site Health and Safety Coordinator or SHSC:**

“Site Health and Safety Coordinator” or “SHSC” shall have the meaning set forth in Section 3.06.

1.60 **Special Conditions:**

“Special Conditions” means the Special Conditions issued by the Port of Houston Authority in connection with and for the Project.
1.61 **Specifications:**

The “Specifications” are that portion of the Contract Documents consisting of the written requirements for Equipment and Materials, construction systems, standards and workmanship for the Work and performance of related services, and include the Technical Specifications for the Project. Specifications may be separate or set forth on the Drawings, or both.

1.62 **Standard of Care:**

The “Standard of Care” has the meaning set forth in Section 4.01(a).

1.63 **Start Work Date:**

The “Start Work Date” shall mean the date set forth in the Notice to Proceed for the Contractor to begin Work.

1.64 **Subcontractors:**

The term “Subcontractor” means any person having a direct or indirect contract with the Contractor, at any tier, for design or engineering, or for the supply and erection of Equipment and Materials, or for the performance of a portion of the Work, in each case forming part of the Work.

1.65 **Submittals:**

“Submittals” are Shop Drawings, Product Data, Samples and other information provided by the Contractor setting forth its proposed Equipment and Materials, procedures, means or methods for how it intends to comply with the Contract Documents. Submittals are not Contract Documents.

1.66 **Substantial Completion:**

“Substantial Completion” shall have the meaning set forth in Section 6.10, and the date of Substantial Completion is the date established pursuant to Section 6.10.

1.67 **Supplier:**

A “Supplier” is a person having a direct or indirect contract with the Contractor, at any tier, only for the supply of Equipment and Materials.

1.68 **Taxes:**

The term “Taxes” means all taxes, duties, fees or other charges levied or imposed by any country, state or any political subdivision thereof, including but not limited to income, capital, sales, excise and use taxes, customs duties, stamp duties, fees or charges, levies in respect of social welfare, health, workers’ compensation, pension, unemployment or other similar insurances or programs, whether imposed by withholdings or otherwise, and except as otherwise expressly provided, whether existing at the date of this Contract or created and imposed at a later date.
1.69  **Technical Specifications:**

The “Technical Specifications” are those written specifications designated by the Port Authority as the Technical Specifications for the Project.

1.70  **Work:**

The “Work” is all obligations of the Contractor under the Contract Documents and all Equipment and Materials, labor, construction, management, supervision, services and activities of every kind and nature, whether commenced or not, or completed or partially completed, undertaken by the Contractor, provided or to be provided by the Contractor, or inferable from the Contract Documents to perform and fulfill all of the Contractor’s obligations pursuant to the Contract Documents. The Work may constitute the whole or a part of the Project.

1.71  **Working Day:**

A “Working Day” is a calendar day, excluding Saturdays, Sundays and the A. G. C. holidays for the applicable year, when Work can be performed for a period of not less than seven (7) hours between 7:00 AM and 6:00 PM. AGC holidays falling on Sunday are observed on Monday. Holidays falling on Saturday are not observed.

1.72  **Work Product:**

“Work Product” shall have the meaning set forth in Section 2.05.

END OF GENERAL CONDITIONS SECTION 1
SECTION 2. CONTRACT DOCUMENTS

2.01 Intent of Contract Documents:

(a) The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. These General Conditions, in conjunction with the other Contract Documents, all of which constitute a part of this Contract, are each intended to be cooperative; a provision occurring in one is as binding as though occurring in all, and when read together are intended to describe and provide for a finished piece of work, complete in every detail. Work not expressly set forth in the Contract Documents will be required to the extent it is consistent therewith and is inferable therefrom as being necessary to produce the intended results. Omissions from the Contract Documents or the incorrect description of details of Work which are manifestly necessary to carry out the intent of the Contract Documents, or which are customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described details of the Work, but they shall be performed as if fully and correctly set forth and described in the Contract Documents.

(b) The organization of the Specifications into divisions, sections and articles, and the arrangement of the Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

(c) Unless otherwise stated or defined in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

2.02 Precedence of Contract Documents:

(a) If there is an irreconcilable conflict between Contract Documents, the document highest in precedence shall control, but except in such event and to avoid such conflict, every construction of provisions shall be that each is in aid to, or supplementary to or complementary of, each other provision, to control and secure for the Port of Houston Authority the completion of the entire Work in an expeditious, orderly and coordinated manner. The precedence, from highest to lowest, shall be in the following order:

1. Permits for the Work from Governmental Authorities as may be required by law;
2. Special Conditions;
3. General Conditions;
4. Specifications;
5. Drawings.

The most recently issued document takes precedence over previously issued forms of the same document. Modifications take precedence over applicable previously issued documents under items 2 through 5 above. Detailed Drawings shall take precedence over general Drawings.

(b) Should there be an irreconcilable conflict of terms within the Drawings or within the Specifications, the Contractor shall be obligated to provide the most expensive combination of quality and quantity of Work indicated. The Port Contract Representative will clarify the Project requirements in the event of an above mentioned conflict that affects the Contractor. In general,
1. figures take precedence over scale measurements;

2. large scale details take precedence over smaller scale details;

3. architectural Drawings take precedence in regard to dimensions, when in conflict with mechanical and structural Drawings, except for the size of the structural members;

4. specifically titled Drawings and sections of the Specifications take precedence over indication of the item in a collateral way;

5. existing conditions take precedence over Drawings and Specifications for dimensions.

2.03 References:

(a) Unless expressly stated otherwise in the Contract Documents, references to codes, standards, pamphlets, specifications and recommendations of trade associations, technical societies, or of manufacturers, refer to the latest edition of each which is effective on the date of the Invitation to Proposers. Manufacturers’ specifications and recommendations shall be construed to mean those printed on container labels or in published manuals, catalogues, or instruction sheets.

(b) The codes, standards, pamphlets, specifications and recommendations of trade associations, technical societies, or of manufacturers shall not apply to the extent:

1. that they provide requirements less stringent than those set forth in the Contract Documents, the requirements of which apply as minimums only. For the avoidance of doubt, such codes, standards, pamphlets, specifications and recommendations do not supersede more stringent requirements set forth in the Contract Documents;

2. that they include exclusions, limitations or waivers that are inconsistent with the Contract Documents.

2.04 Special Conditions:

If any construction, work or condition which is not covered by these General Conditions be anticipated by the Port of Houston Authority on any proposed Work, Special Conditions for such Work will be attached to and shall be a part of the Contract.

2.05 Ownership and Use of Drawings, Specifications and Work Product:

All Drawings, Specifications, other documents, including those in electronic form, and the architectural works (as defined by 17 U.S.C. Section 101) embodied thereby, prepared in connection with the Project by the Port of Houston Authority, Design Consultant, Contractor, Subcontractor, any consultant, Supplier, or other contractor and copies thereof furnished by any of them are and shall remain the Port of Houston Authority’s property upon creation, and the Port of Houston Authority shall hold all common law, statutory and other rights in them, including all copyright rights (collectively “Work Product”); provided, however, that Work Product shall not include (a) administrative information developed by the Contractor, its Subcontractors, consultants, Suppliers, or other contractors in the ordinary course of business (e.g., accounting records, internal memorandums and the like), (b) means or methods of Contractor, its Subcontractors, consultants, Suppliers, or other contractors which relate to its general services and which are not specifically related to the Project or the services provided under this Contract, or (c) pre-existing proprietary information of the Contractor, its Subcontractors, consultants, Suppliers, or other contractors (the foregoing (b) and (c) collectively being “Contractor Proprietary Information”). To this end, Contractor agrees and does hereby assign, grant, transfer and convey to the Port of Houston Authority
Authority, its successors and assigns, Contractor’s entire right, title, interest and ownership in and to such Work Product, including, without limitation, all rights relating to copyright arising under 17 U.S.C. Section 101 et. seq. and any and all successors and assigns shall own Contractor’s right, title and interest in and to, including the right to use, reproduce, make derivative works, distribute by sale, rental, lease or lending or by other transfer of ownership, to perform publicly, and to display, all such Work Product, whether or not such Work Product constitutes a “work made for hire” as defined in 17 U.S.C. Section 201(b). In addition, the Contractor hereby grants the Port of Houston Authority a fully paid-up, royalty free, perpetual, assignable, non-exclusive license to use, copy, modify, create derivative works from, and distribute to third parties Contractor Proprietary Information in connection with the exercise of the Port of Houston Authority’s rights in the Work Product and in the operation, maintenance, repair, renovation, expansion, replacement and modification of the facilities and other Work which are the subject matter of the Project (whether by the Port of Houston Authority or a third party). Contractor shall use diligent efforts to obtain similar assignments, confirmations and licenses from all of its Subcontractors, and Suppliers, and Contractor shall promptly inform the Port of Houston Authority of any inability to obtain the assignments, confirmations and licenses required by this Section. The Work Product is to be used only by the Contractor, its Subcontractors, and Suppliers with respect to this Project and is not to be used on any other project. The Contractor, Subcontractors, and Equipment and Material Suppliers are granted a limited license to use and reproduce applicable portions of the Work Product prepared by the Port of Houston Authority and any Design Consultant appropriate to and for use in the execution of their Work under the Contract Documents. Submission or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Port of Houston Authority’s copyright or other reserved right. Contractor shall deliver all copies of the Work Product to Port of Houston Authority upon the earlier to occur of the Port of Houston Authority’s request, completion of the Work, or termination of the Contract.

The Port of Houston Authority may provide the Contractor with pre-existing drawings, documents, designs, and other information which the Contractor may use in connection with performance of the Work under this Contract. The Contractor confirms and agrees that the Port of Houston Authority has and shall retain all rights, title, and interest in and to such drawings, documents, designs and information, including, without limitation, any copyright or other Intellectual Property Rights, and that by use of such drawings, documents, designs and information, the Contractor shall not acquire any right, title, or interest in such drawings, documents, designs and information, including, without limitation, any copyright or other Intellectual Property Rights.

2.06 Examination of Drawings, Specifications, Special Conditions and Site of Work:

(a) In entering into the Contract, the Contractor represents and warrants that it has and shall be deemed to have carefully examined and inspected the Site and its surroundings and satisfied itself as to the condition of all circumstances affecting the Site and the Work, including without limitation the location and nature of the Work, nature of the geotechnical conditions, ground and subsoil, the form and nature of the Site, the subsurface conditions of the Site (both manmade and natural), the local conditions under which the Work is to be performed, the location and character of existing or adjacent work or structures, the Contract Documents, the extent and nature of the Work, Equipment and Materials necessary for carrying out and completing the Work, the buy out and availability and cost of Equipment and Materials, the general character and accessibility of the Site, Applicable Law (including without limitation labor laws), labor supplies and costs, any accommodations the Contractor may require, other general and local conditions which might affect the Work or performance of the Work, and in general all risks and contingencies influencing or affecting the Work, and correlated its observations with the requirements of the Contract Documents, and, subject to the right set forth below to rely upon specified Port of Houston Authority supplied information, that the Contractor has assumed the risk of such conditions and will, regardless of such conditions, the expense, or difficulty of performing the Work, fully complete the Work for the stated Contract Price and within the Contract Time without further recourse to the Port of Houston Authority.
The Contractor fully accepts any lack of completeness of and errors in the Contract Documents, including the Drawings and Specifications, and verifies that such documents were sufficiently detailed, accurate and comprehensive to enable Contractor to have reliably estimated and established the Contract Price and to perform the Work within the Contract Time.

The representations, warranties and acceptances set forth in the foregoing two paragraphs of this Section 2.06 shall be renewed and apply to all Work, conditions, circumstances, and Contract Documents associated with any Modifications.

The Contractor shall not be entitled to any extensions of the Contract Time or to any adjustment of the Contract Price on grounds that it misinterpreted or misunderstood any matter assumed by the Contractor pursuant to this Section 2.06, nor shall it be released from any of the risks accepted or obligations undertaken by it under the Contract Documents, or on the grounds that it did not or could not reasonably have foreseen any matter which affects the execution of the Work.

(b) The Port of Houston Authority makes no representation or warranty, and hereby disclaims any such warranty, that any information provided to the Contractor by or on behalf of the Port of Houston Authority in connection with the Work is accurate, correct, sufficient, complete, fit for its intended purpose or can be used without infringing any Intellectual Property Rights of third parties under any intellectual property rights of the world.

(c) Notwithstanding the foregoing, in instances in which the Port of Houston Authority has supplied the Contractor with geotechnical reports or in which the Special Conditions specify that the Contractor is entitled to rely upon other information provided by the Port of Houston Authority, the Contractor

1. shall not be required to perform any investigation of the conditions described in such geotechnical reports or other information, other than its observation of the Site and review of such technical reports and information, and
2. is entitled to rely upon such information in submitting its Bid/Proposal and performing the Work,

in each instance except to the extent that the Contractor knows or should know in the exercise of its Standard of Care that such information is inadequate, insufficient or incorrect.

2.07 Bid/Proposal Quantities:

The quantities shown on the Bid/Proposal Request are estimates and are for comparison of bids/proposals only, and while such quantities are believed to be reasonably accurate, the Port of Houston Authority does not guarantee their accuracy.

The Contractor must make its own take-off and base its price or prices on the results thereof. No Change Order shall be issued and Contractor shall not be entitled to any Change on account of any excess or deficiency with respect to such information whether absolute or relative in relation to quantities stated in the Bid/Proposal Request. Contractor acknowledges and agrees that any such excess or deficiency shall not be the basis for a Claim, that Contractor will not assert or pursue and has no right to assert or pursue a Claim on the basis of any such excess or deficiency, and any such excess or deficiency shall not entitle Contractor to any relief or recovery, whether for additional compensation, additional time, damages or otherwise. The foregoing is not intended to preclude Change Orders to adjust an estimated contract price in instances in which the Contract Price (as opposed to set unit costs) is not fixed or guaranteed not to exceed a specified amount, but, rather is established at Final Completion of the Work on the basis of actual quantities of Work.
Without limiting the foregoing and subject to Section 2.06 above, any information given in regard to soil data, subsurface data, test borings and similar conditions is to be considered approximate.

2.08 Interpretation of Contract Documents:

(a) The Port of Houston Authority and Contractor recognize the possibility that errors, omissions and discrepancies exist in the Contract Documents. The Contractor shall not take advantage of any error or omission in the Contract Documents. At all times, the Contractor shall retain the duty to detect or discover any errors and omissions and make appropriate requests in respect thereof. Before starting each portion of the Work, the Contractor shall carefully study and compare the various Drawings and other Contract Documents relating to that portion of the Work, as well as the information furnished by the Port of Houston Authority, shall take field measurements of any existing conditions related to that portion of the Work and shall observe any conditions at the Site affecting such Work. Any errors, omissions or inconsistencies discovered by the Contractor shall be reported promptly to the Port of Houston Authority as an RFI in such form as the Port of Houston Authority may require.

Instructions will be given by the Port Contract Representative to the Contractor when such error or omission is discovered by the Port Construction Representative or when reasonably requested of the Port Construction Representative by the Contractor. Any such problem in the Contract Documents not brought to the attention of the Port Contract Representative prior to Contractor’s submission of its Bid/Proposal will be resolved by the Port Contract Representative in a manner solely within the discretion of the Port Contract Representative. Contractor acknowledges and agrees that any such resolution shall not be the basis for a Claim, that Contractor will not assert or pursue and has no right to assert or pursue any Claim on the basis of any such resolution, and any such resolution shall not entitle Contractor to any relief or recovery, whether for additional compensation, additional time, damages or otherwise. In addition, if the Contractor performs any Work when it knew or should have known it involves an error, inconsistency or omission in the Contract Documents without such notice to the Port of Houston Authority and receiving a written order or consent to proceed, the Contractor shall assume full responsibility for such Work and shall be responsible for any and all costs to the Port of Houston Authority attributable to such performance, including without limitation all costs associated with design professionals or other consultants and costs of correction of the Work, and liable for all damages caused thereby.

(b) If the Contractor observes that any Contract Document fails in any respect to conform with Applicable Laws, Contractor shall immediately notify the Port of Houston Authority by written RFI and identify any such failures before proceeding with any part of the Work affected thereby. In the event a Design Consultant is utilized for the Project, the Contractor shall send such RFI to the Port Construction Representative, with a copy of the transmittal letter to the Inspector and Design Consultant. If the Contractor fails to notify the Port of Houston Authority as required in the preceding sentence, the Contractor shall be liable for any damages, costs, fines or liability resulting therefrom, including, without limitation, any fines, design professional fees, consulting fees, and costs of correction of the Work.

If the Contractor performs Work when the Contractor knows or should know it to be contrary to Applicable Laws without such notice to the Port of Houston Authority and appropriate instruction, the Contractor shall assume full responsibility for such Work and shall bear all costs attributable to correction and be liable for any and all damages, fines, costs and fees caused thereby, including, without limitation, design professional fees and consulting fees.

(c) In the execution of the Work, the Drawings shall be accurately followed to scale giving preference in all cases to figured dimensions over scale measurements and to details over general Drawings. Where any discrepancy occurs between figured dimensions and scale or between details and general Drawings, the Contractor shall provide notice of such discrepancy in an RFI, which RFI shall set forth the facts constituting such discrepancy in a degree of detail acceptable to the Port of Houston Authority.
Authority, to the Inspector who shall provide explanation and instructions as to which is to govern before the Contractor proceeds with the Work at issue. In the event there is a Design Consultant for the Project, the Contractor shall send the RFI to the Port Construction Representative, with a copy of the transmittal letter to the Inspector and the Design Consultant. Departure from the Contract Documents in the execution of the Work without the Port Contract Representative’s prior written order or consent will be at the Contractor’s sole risk and expense and the Contractor shall assume full responsibility for such Work and shall be responsible for any and all damages, costs or liability resulting therefrom, including, without limitation, any and all fines, design professional fees, consulting fees, increased costs of performance of the Work, and costs of correction of the Work.

(d) The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Port of Houston Authority or the work installed by other contractors, is not guaranteed by the Port of Houston Authority. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, conditions and locations. In all cases of interconnection of its Work with existing or other work, it shall verify at the Site all dimensions relating to such existing or other work. Any errors due to the Contractor’s failure to so verify all such grades, elevations, locations, conditions or dimensions shall be promptly rectified by the Contractor without any additional cost to the Port of Houston Authority.

(e) The Contractor shall at once report in writing to the Port of Houston Authority any materials, systems, procedures or methods of construction, either shown on the Drawings or specified, which it considers to be incorrect, inadequate, obsolete, unsuitable for the purpose intended, or which would not satisfy the Standard of Care or warranties required by the Contract Documents. If Contractor proceeds with such Work without reporting such concerns and instruction to proceed from Port of Houston Authority, the Contractor shall assume full responsibility for such Work and shall be responsible for any and all damages, costs or liability resulting therefrom, including, without limitation, any and all fines, design professional fees, consulting fees, increased costs of performance of the Work, and costs of correction of the Work.

(f) When more than one material, brand or process is specified for a particular item of Work, the choice shall be the Contractor’s. The final selection of color and pattern shall be made from the range available within the choice selected by the Contractor, unless the item is specified to match a specific color or sample furnished. Where Equipment and Materials are specified by brand name, trade name, or manufacturer, only products of those named manufacturers are acceptable unless equal Equipment and Materials of other manufacturers are accepted in writing by the Port Contract Representative before submittal of Bids/Proposals or the Port Contract Representative accepts a substitution in compliance with Section 4.10. The Contractor shall not be allowed to supply equal or alternative Equipment and Materials not so accepted. The judgment of the equality of Equipment and Materials or products rests solely with the Port Contract Representative, and its decision shall be final. Specified architectural, construction or equipment details may not be regularly included as part of the named manufacturer’s standard items or Equipment and Materials, but shall be provided by the manufacturer as required for the Project or the proper functioning of the Equipment and Materials. Indicated and specified performance and Equipment and Materials requirements are minimum, and are required in addition to standard performance and accessories provided by the manufacturer.

(g) If the Contractor believes that additional cost or time is involved or that it is entitled to a Change, recovery of any damages or other relief because of clarifications or instructions issued by the Port of Houston Authority in response to the Contractor's notices or requests for information pursuant to this Section 2.08, the Contractor shall make Claims as provided in Section 8; provided, however, that no adjustment in the Contract Time or Contract Price, recovery of damages or other relief shall be granted if the adjustment would be prohibited pursuant to this Section 2.08.
2.09 **Performance & Payment Bonds:**

Unless otherwise provided in the Special Conditions, each Contract at its inception shall be covered by a performance bond and a payment bond, each for 100% of the Contract. Bonds must be furnished with the executed Contract. Such bonds must be furnished on the Port of Houston Authority forms. No other forms are acceptable. Such bonds must remain in full force for one year after final acceptance of the Finally Completed Work and cover all obligations of the Contractor during such one year period, specifically including all repair and warranty obligations of the Contractor. Performance and payment bonds must meet all criteria of Texas law and both must be executed by the same corporate surety which shall be (i) duly authorized and admitted to do business in the State of Texas, (ii) licensed by the State of Texas to issue surety bonds and (iii) listed in the current issue of the Federal Register Department of the Treasury list. Moreover, such surety must show adequate bonding capacity for the size of the proposed Project. The Port of Houston Authority will not accept bonds from surplus lines or Texas Lloyds Plan insurance companies. The Port of Houston Authority shall be the sole judge of the validity and adequacy of any bonds submitted.

2.10 **Port Authority Financial Services Department Approval:**

No Contract shall become effective or binding upon the Port of Houston Authority until the appropriate financial officer for the Port of Houston Authority certifies that funds are or will be available to meet the Contract pay requirements when due.

2.11 **Port of Houston Authority Purchase Order:**

The Purchasing Manager shall prepare a Purchase Order on the form prescribed by the Port of Houston Authority and mail or otherwise deliver the same along with one fully executed copy of all other Contract Documents to the Contractor. The date of the Purchase Order is the date of the Contract. The Contractor is not authorized to begin Work under the Contract Documents until after the Port of Houston Authority has issued a fully executed Purchase Order and the Port Construction Representative has issued a Notice to Proceed pursuant to Section 6.01; the Contractor shall not start Work before the Start Work Date and shall not begin field work until the time established pursuant to Section 6.02. If Contractor begins work prior to issuance of a fully executed Purchase Order and receipt of a Notice to Proceed, it does so at its own risk and agrees to assume all responsibility therefor, to bear all costs attributable thereto, including without limitation all costs associated with design professionals, and to be liable for all damages caused thereby.

**END OF GENERAL CONDITIONS SECTION 2**
SECTION 3. REGULATORY, ENVIRONMENTAL, AND SAFETY REQUIREMENTS

3.01 Laws to be Observed:

The Contractor is deemed to have made itself familiar with and at all times shall observe and comply with and give all notices required by all Applicable Laws, and shall, in accordance with Sections 11.08 and 11.09, INDEMNIFY AND SAVE HARMLESS THE PORT OF HOUSTON AUTHORITY INDEMNITEES AGAINST ANY CLAIM, DEMAND, SUIT, CAUSE OF ACTION, LIABILITY, COST, EXPENSE, FINE, SETTLEMENT OR JUDGMENT ARISING FROM THE VIOLATION OF, OR FAILURE BY CONTRACTOR, ITS SUBCONTRACTORS, SUPPLIERS OR ANY OF ITS OR THEIR EMPLOYEES, AGENTS OR REPRESENTATIVES, TO COMPLY WITH ANY SUCH APPLICABLE LAWS.

3.02 Building Codes and Applicable Laws:

Where the requirements of the local building code or other Applicable Laws conflict with the Contract Documents and such requirements are mandatory or more restrictive, such requirements shall be followed to the same extent as if specifically set out herein in full.

Provisions of the Contract Documents which are more stringent than the minimum requirements of such codes, regulations or Applicable Laws shall be followed, and no requirements of the Contract Documents may be modified or voided because any such requirements are not specifically required by such codes, regulations or Applicable Laws.

3.03 Permits and Licenses:

The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incidental to the prosecution of the Work, including, but not limited to, the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work. This requirement shall not pertain to permits required by the United States Army Corps of Engineers, which permits will be obtained by the Port of Houston Authority.

The Contractor shall obtain approvals of Government Authorities and shall procure, obtain and pay all charges for all permits and approvals prior to impeding or closing streets, removing parking meters and other similar matters as may be necessary or appropriate from time to time for the performance of the Work, and shall notify the Port Contract Representative at least 48 hours prior to closing a road or a road crossing.

If the Contractor fails to give such notices, pay such charges, or obtain such permits and licenses, the Contractor shall be liable for and SHALL INDEMNIFY, PROTECT AND HOLD HARMLESS THE PORT OF HOUSTON AUTHORITY INDEMNITEES AGAINST THE RESULTING FINES, PENALTIES, JUDGMENTS AND DAMAGES, INCLUDING REASONABLE ATTORNEYS’ FEES, IMPOSED ON, OR INCURRED BY, THE PARTIES SO INDEMNIFIED.

3.04 Permit for Welding and Cutting:

A “hot work” permit must be obtained from the Port of Houston Authority’s Marine and Fire Department prior to commencement of any welding or cutting on Port of Houston Authority property or on a barge, platform, or other floating facility. Prior to commencement of such “hot work”, the Contractor shall also contact other applicable local fire departments to determine the need for any other permits which may be required by such departments. Once the “hot work” permit is executed and issued to the Contractor by the Port of Houston Authority’s Marine and Fire Department, the Contractor must notify such department by telephone at (713) 670-2636 each day before a day during which such activity is scheduled to take place.

Long Form General Conditions
(Form Revision Date: May 2014)
3.05 **Safety:**

(a) The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Work. The Contractor shall take precautions for safety of, and shall provide protection to prevent damage, injury or loss to:

(i) employees involved in the Work and other persons on Site or otherwise who may be affected thereby;

(ii) the Work and Equipment and Materials to be incorporated therein, whether in storage on or off the Site, under care, custody or control of the Contractor or the Contractor’s Subcontractors of any tier; and

(iii) other property at the Site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

(b) The Contractor shall be solely responsible for furnishing, erecting and maintaining suitable barricades, warning signs, flares, barriers, cones, lights, flags, signals, flagmen and any and all other safety devices which are or may become necessary to adequately protect the Work, Contractor’s workers and all other parties coming onto the Site. The Contractor shall also be responsible, at the Contractor’s sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein. Any damage to such property or improvements shall be promptly repaired by the Contractor with prior approval of the Port of Houston Authority.

Upon Final Completion of the Work, all such safety devices and evidence thereof shall be immediately removed.

3.06 **Site Health and Safety Coordinator:**

The Contractor shall designate a qualified Site Health and Safety Coordinator (the “SHSC”) to ensure that all Applicable Laws pertaining to health and safety are complied with and all health and safety requirements are implemented. The SHSC shall have the authority to terminate any activity when any such activity or condition affecting such activity, the Work or the Project is found to be unsafe. The name and qualifications of the SHSC shall be furnished to the Port Construction Representative for review prior to commencement of Work.

3.07 **Health and Safety Plan:**

The Contractor shall submit five (5) copies of a health and safety plan for the Work to the Port Construction Representative for review at least forty-eight (48) hours prior to commencing performance of any activity at the Site. Prior to beginning any field work at the Site, such plan shall be certified, by signature of the SHSC, that it complies with applicable portions of Occupational Safety and Health Administration (OSHA) standards 29 CFR 1910 and 29 CFR 1926. Such plan shall provide, at a minimum, for safe working practices, medical surveillance, engineering safeguards, personnel protective equipment, training, safe operating procedures, emergency planning, reporting and sanitation. Notwithstanding the Port Construction Representative’s review and acceptance of the health and safety plan, the Contractor, and not the Port of Houston Authority, shall be responsible for and have control over ensuring the safety of its personnel and its Subcontractors, agents, representatives and any other person who visits the Site.
3.08 **Safety and Environmental Record:**

Pursuant to Texas Water Code Section 60.4115, the Port of Houston Authority will require the Contractor to supply information regarding the safety and environmental record of Contractor. Contractor should be aware that its failure to comply with the requirements of Texas Water Code Section 60.4115 may result in termination of the Contract.

3.09 **Environmental Management System:**

The Port of Houston Authority has developed an Environmental Management System (EMS) based on the ISO 14001 standard. As part of the EMS, the Port of Houston Authority has adopted an environmental compliance policy with commitments to pollution prevention, environmental compliance, continual improvements, and environmental stewardship. The Contractor shall adhere to such policy and programs, as applicable, and provide information to the Port of Houston Authority in the form and at the times requested by the Port of Houston Authority in furtherance of such policy and programs.

3.10 **Environmental Training Documentation:**

The Contractor shall submit documentation of environmental training applicable to the Work upon request by the Port of Houston Authority.

3.11 **Spill Prevention Plan:**

Contractor shall provide a Site/Project specific Spill Prevention Plan or Spill Prevention Control and Countermeasure Plan (as applicable) for review and acceptance pursuant to the provisions of Section 4.10. A Spill Prevention Plan, for projects with less than 1320 gallons of oil, as defined by 40 CFR part 112.2, shall meet at a minimum the requirements set forth in Section 3.11(a) below. A Spill Prevention Control and Countermeasure Plan, for projects with 1320 gallons of oil or greater, as defined 40 CFR part 112.2, shall meet at a minimum the requirements listed in Section 3.11(b) below.

a. **Projects with less than 1320 gallons of oil on Site:**

Contractor shall complete a Spill Prevention Plan accepted by the Port of Houston Authority for projects with less than 1320 gallons of oil on-Site. The Contractor shall not commence any field work prior to acceptance of such plan by the Port Construction Representative. The Spill Prevention Plan shall include at a minimum:

1. A brief project description, which should include, at a minimum: Facility name, Location, Size of Work Area, Work Scope or Activity Description.

2. A brief description of best management practices to avoid spills, including containment methods, spill proof cans, labels, etc.

3. A brief description of spill, material on hand, for example gloves, respirator, tyvek suit, equipment, absorbent.

4. A list or brief description of Spill/Incident/Release Reporting and Response Procedures, Including:
a. FIRST RESPONSE – CALL PORT OF HOUSTON AUTHORITY POLICE
   713-670-3611
b. Field Supervisor 24-hour phone numbers
c. Other company personnel 24-hour phone numbers
d. Local, state, and federal emergency response phone numbers
e. Emergency Response Contractor phone numbers that has been notified by company regarding project.

(5) A listing of all hazardous or potentially hazardous materials/chemicals that may be used on-Site during the project (including fuel, oil, fluids, solvents, etc.) and a copy of the Material Safety Data Sheet for each such material.

b. Projects with 1320 gallons or greater of oil on Site:

   Contractor shall complete a Spill Prevention Control and Countermeasure Plan accepted by the Port of Houston Authority for projects that will have 1320 gallons or more of oil on Site. The Spill Prevention Control and Countermeasure Plan (SPCC) must meet the requirements of Code of Federal Regulations (CFR) published by the office of the Federal Register National Archives and Records Administration, 40 CFR 112.3 – 112.7. The SPCC shall be specially designed for the Contractor’s planned work methods and procedures. The SPCC shall be designed to complement all applicable safety standards, fire prevention regulations and pollution prevention policies and procedures. The SPCC shall include estimates of the quantity and rate of flow should equipment fail, and detail containment and/or diversionary structures to prevent spills from leaving the Site or migrating into the Houston Ship Channel or other navigable waters. The SPCC shall include methods of recovery of spilled materials and all applicable twenty-four (24) hour emergency phone numbers, including without limitation that of the Port of Houston Authority Police. The Contractor shall not commence any field work prior to acceptance of such plan by the Port Construction Representative.

c. Reporting:

   (1) The Contractor shall immediately report any spill or release to the Port of Houston Authority's Police Department at telephone number (713) 670-3611 and to the Inspector, whether or not such spill or release is associated with this Contract. Thereafter, within two (2) Working Days after the occurrence of such event, Contractor shall submit a written report describing such event in a degree of detail reasonably acceptable to the Port Construction Representative and

   (2) If a spill migrates into the Houston Ship Channel or other navigable waters, in addition to the requirements of the foregoing Section 3.11(C)(1), the Contractor shall contact the U. S. Coast Guard Response Supervisor at telephone number (713) 671-5121, to review procedures and the Spill Prevention Plan or SPCC and coordinate activities and schedules, prior to commencement of cleaning activities.

d. Implementation:

   The Contractor shall immediately respond in accordance with the Spill Prevention Plan or SPCC Plan in the event of a spill.
e. **Disposal:**

The Contractor shall dispose of spilled materials in accordance with EPA and TCEQ regulations and any other Applicable Laws. In connection with such disposals, the Contractor shall use only those transporters and disposal facilities that are accepted in advance by the Port of Houston Authority. All cost of collection, containment and disposal of spilled materials shall be the responsibility of the Contractor.

### 3.12 Accident Reporting and Emergencies:

The Contractor shall immediately report to the Port of Houston Authority’s Police Department at telephone number (713) 670-3611 and the Inspector of the Port of Houston Authority any jobsite accident, injury, illness, or environmental Release. The Contractor shall submit to the Inspector of the Port of Houston Authority as soon as possible but no later than two (2) Working Days thereafter, a full written report giving the date, time, location, description (in a degree of detail acceptable to the Port Contract Representative), and personnel involved. Such report shall be signed by Contractor’s designated SHSC.

In an emergency affecting safety of persons or property, the Contractor shall immediately notify the Port of Houston Authority’s Police Department at telephone number (713) 670-3611 and the Inspector of the Port of Houston Authority and undertake such acts as are necessary, at the Contractor’s discretion, to prevent threatened damage, injury or loss. Any Claim by the Contractor for additional compensation, an extension of time, other relief or damages on account of an emergency shall be made and determined in accordance with Section 8.

### 3.13 Discovery of Hazardous Substances:

In the event the Contractor encounters on the Site materials reasonably believed to be Hazardous Substances that have not been rendered harmless, the Contractor shall immediately stop Work in the affected area and report in writing the facts of such encounter to the Port Contract Representative, the Port of Houston Authority Police, and the Inspector. Work in the area affected shall not thereafter be resumed except by written order of the Port Contract Representative unless and until the material is determined not to be Hazardous Substances or such Hazardous Substances are rendered harmless.

The Contractor shall be responsible for identification, abatement, cleanup, control, removal, remediation and disposal of any Hazardous Substances in or on the Site brought to the Site by the Contractor or any Subcontractor or Supplier (other than any Hazardous Substances that are required by the Contract Documents to be used in connection with the Work). Contractor shall obtain any and all permits necessary for the legal and proper handling, transportation, and disposal of such Hazardous Substances and shall, prior to undertaking any such abatement, cleanup, control, removal, remediation and disposal, notify the Port of Houston Authority Police, and the Port Contract Representative such that they may observe such activities; provided that it shall be Contractor’s sole responsibility to comply with Applicable Law governing any such activities.

### 3.14 Characterization and Disposal of Excavated Materials and Certain Other Waste:

(a) Prior to removing materials requiring disposal off-site, the Contractor shall stockpile such materials. The Port of Houston Authority shall characterize such stockpiled materials prior to removal of such materials from the Site. The Port of Houston Authority shall perform all the necessary analytical testing and/or waste determinations for all excess excavated earthen, trash and construction debris materials. The determination by the Port of Houston Authority as to the characterization of such materials shall be final and conclusive.
(b) The Contractor shall submit to the Port Construction Representative the names of all Subcontractors transporting excess excavated earthen, trash and construction debris materials, locations of all disposal sites where such materials will be disposed of, and copies of any permits required for such Subcontractors to so transport and dispose of such materials at least twenty (20) working days in advance of the proposed schedule to move them. Such Subcontractors must be approved by the Port of Houston Authority prior to the removal of any such material from the Site. All such material must be disposed of at the approved location(s) and the Contractor shall provide documentation to the Port of Houston Authority evidencing to the satisfaction of the Port of Houston Authority the final disposition of all such materials, including without limitation written documentation from the receiving facility acknowledging receipt of the analytical report(s) for such materials, and its acceptance of such materials at that location.

(c) In the event the Contractor intends to reuse excavated and excess materials, rather than dispose of them as provided above, the Contractor shall additionally submit proposed reuse locations and its proposed new uses for such materials to the Port Construction Representative at least twenty (20) working days in advance of the proposed schedule to move them. The Port of Houston Authority reserves the right to accept or reject any reuse of excavated and excess materials removed from Port of Houston Authority properties by the Contractor, and limit such reuse to future use at industrial sites only, and not in any residential or other sensitive area. The Port of Houston Authority reserves the right to determine whether a site location is sensitive.

3.15 **Cultural Resources:**

The Contractor shall not remove or disturb, or cause or permit to be removed or disturbed, any historical, archaeological, architectural, or other cultural artifacts, relics, vestiges, remains, or objects of antiquity. If any such items are discovered on the premises, the Contractor shall immediately notify the Port Construction Representative of the Port of Houston Authority of such discovery, and the Site and the items discovered shall be protected by the Contractor from further disturbance until a professional examination of them can be made or until clearance to proceed is authorized by the Port Contract Representative.

3.16 **Sanitary Facilities:**

Unless stated otherwise in the Special Conditions, the Contractor shall provide sanitary facilities for use of the workmen, and shall maintain such facilities in a clean and sanitary condition until the expiration or termination of the Contract, at which time they shall be immediately removed.

3.17 **Use of Site:**

The Contractor shall confine operations at the Site to areas permitted by Applicable Laws and the Contract Documents and shall not unreasonably encumber the Site with Equipment and Materials or other items. The Contractor shall avoid disturbing the Site beyond that which is necessary to effect construction or to create designated lay-down areas.

The Contractor shall use the designated work areas for the temporary storage of construction Materials, Equipment, and debris. Additional Contractor work areas must be approved through the submittal process. Only Equipment and Materials which are to be used directly in the Work shall be brought to and stored on the Site by the Contractor. After Equipment and Materials is no longer required for the Work, it shall be promptly removed from the Site. Protection of Equipment and Materials stored at the Site from weather, theft, damage, and all other adversity is solely the responsibility of the Contractor.
Equipment and Materials shall, to the satisfaction of the Port Construction Representative, be neatly, safely and compactly piled or stacked so as to minimize hazard, interference, inconvenience and damage to property owners, users of Port of Houston Authority property or facilities, Port of Houston Authority employees and the general public. Such stacks or piles shall be no closer than three feet from any fire hydrant and shall not block or interfere with public and private accessways, drives and streets.

Shade trees, improvements and other structures shall be protected from any damage by personnel, activities, Equipment and Materials, machinery, stone, earth or other items. Altering the condition of properties adjacent to, along or outside of rights-of-way will not be permitted. Means, methods, techniques, sequences, or procedures, which will result in damage to such properties or improvements will not be permitted. Injuries and damage to any of the foregoing, including accessways, drives, streets, improvements or other property, shall be repaired or replaced by the Contractor to the satisfaction of the Port Contract Representative at the Contractor’s sole expense.

The Contractor shall avoid obstructing drainage ditches or inlets; when obstruction is unavoidable due to requirements of the Work, the Contractor shall provide grading and temporary drainage structures to maintain unimpeded flow. The Contractor shall provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment or large or heavy trucks or equipment. The Contractor shall provide temporary crossing or complete the excavation and backfill in one continuous operation to minimize the duration of obstruction when excavation is required across drives or entrances.

The Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the Site and all adjacent areas. The Contractor shall avoid obstructing driveways or entrances to private property and shall maintain access for emergency vehicles, including access to fire hydrants, at all times during the prosecution of the Work. The Work shall be performed, to the fullest extent reasonably possible, in such manner that public areas adjacent to the Site shall be free from all debris and Equipment and Materials. The Contractor shall not leave public roadways or other construction areas unclean overnight. Without limitation of any other provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of (1) any areas and buildings adjacent to the Site, or (2) the buildings which are constructed as part of the Project in the event of partial occupancy.

Vehicles and construction equipment shall not be washed at locations where the runoff will flow directly into a watercourse, storm water conveyance system or into another contractor’s site. Special areas shall be designated for washing vehicles. These areas shall be located where the wash water will spread out and evaporate, or where the runoff can be collected in a temporary holding or settling basin. Wash areas must have gravel or rock bases to minimize mud generation.

3.18 Misplaced Materials:

The Contractor shall prevent any material or other matter from falling into or being placed in the Houston Ship Channel or other navigable waters. Any such material or matter which, in the opinion of the Port Construction Representative, may be dangerous to or obstruct navigation or future dredging, shall be removed immediately. The Contractor shall give immediate notice to the Port Construction Representative of such potential danger or obstruction, and when ordered to by the Port Construction Representative, the Contractor shall mark or buoy such obstructions until they are removed. If the Contractor refuses, neglects or unduly delays compliance with this Section 3.18, such obstruction or potential danger may be removed or otherwise dealt with by the Port of Houston Authority. The Port of Houston has the right to offset all costs incurred in connection with such removal or other effort by the Port of Houston, including without limitation all costs associated with design professionals, against any amounts due the Contractor. Furthermore, if Contractor is not at that time owed any amounts by the Port
of Houston Authority and Contractor fails or refuses to pay such costs, such costs may be recovered from
the Contractor’s surety under the Contractor’s performance bond.

3.19 Fill Material Policy:

(a) The Port of Houston Authority has adopted a policy regarding the acceptance of fill
material to be incorporated into the Port of Houston Authority’s construction Projects. Material governed
by this policy shall include soil, sand for cement stabilized sand and concrete, road base materials, sub-
ballast for railroad construction, and any other materials brought onto Port of Houston Authority property
for construction purposes. It is the intent of this policy to ensure that only clean, uncontaminated
materials as accepted by the Port of Houston Authority will be placed on Port of Houston Authority
property and any materials placed on Port of Houston Authority property shall be subject to removal by
the Contractor at its sole expense if found not to be in compliance with the requirements outlined herein.
Testing to determine the suitability of materials to be used on Port of Houston Authority property shall be
performed by a testing laboratory employed by and paid by the Port of Houston Authority. The following
tests shall be performed:

1. **Total Metals:**

Total metals by volume shall not exceed Texas Commission on Environmental Quality
(TCEQ) standards for the following metals as measured by Environmental Protection
Agency (EPA) Test Method 6010/7000 series.

<table>
<thead>
<tr>
<th>METAL</th>
<th>MEDIAN BACKGROUND CONCENTRATION (mg/kg)</th>
<th>METAL</th>
<th>MEDIAN BACKGROUND CONCENTRATION (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony</td>
<td>1.0</td>
<td>Lead</td>
<td>15</td>
</tr>
<tr>
<td>Arsenic</td>
<td>5.9</td>
<td>Mercury</td>
<td>0.04</td>
</tr>
<tr>
<td>Barium</td>
<td>300</td>
<td>Nickel</td>
<td>10</td>
</tr>
<tr>
<td>Beryllium</td>
<td>1.5</td>
<td>Selenium</td>
<td>0.3</td>
</tr>
<tr>
<td>Cadmium</td>
<td>52*</td>
<td>Silver</td>
<td>96*</td>
</tr>
<tr>
<td>Chromium</td>
<td>30</td>
<td>Thallium</td>
<td>0.7</td>
</tr>
<tr>
<td>Copper</td>
<td>15</td>
<td>Zinc</td>
<td>30</td>
</tr>
</tbody>
</table>

*0.5-acre Residential PCL, Total Soil Combined

2. **Total Petroleum Hydrocarbons (TPH):**

TPH shall not exceed the Tier 1 Residential Standards defined on any of the reported
fractions as determined by Texas Test Method 1005.

(b) **Non-Hazardous Recyclable (Reusable) Materials from Port of Houston Authority Properties:**

1. The excavation of soils containing chemicals above background concentration during
construction activities (e.g., installation, repair, removal of telephone lines or other
utilities, but not closures, remediations, or PST tank removal actions) and the subsequent replacement of those soils into the same excavation are not considered relocation under the definition in 30 TAC 350.36.

2. The excavation during construction activities and removal from Port of Houston Authority properties of soils containing chemicals above background concentration may be considered applicable for recycling if they are listed as Non-Hazardous Recyclable Materials (NRM) under 30 TAC 330 and 335. The NRMs must be collected and processed to ensure they do not present an increased risk to human health, the environment, or waters in the state when applied to the land or used in products that are applied to the land.

Routine candidate materials as NRMs include, but are not limited to concrete asphalt, hydrocarbon impacted soils (class I and II), base materials, sandblast media, slags, lime materials, brick and stormwater sludges, etc.

Upon Contractor’s written request, the Port of Houston Authority shall provide Contractor with analytical results from representative samples obtained for routine materials, as maintained by the Port of Houston Authority.

Samples analyses of routine materials may be performed as indicated in the table below. In the event PCB’s, NORM, Halogens (Chlorinated Compounds) or a Hazardous Waste is suspected, additional analysis may be required. A profile may be completed by the Port of Houston Authority for materials that are intended for transportation off-Site for disposal or recycling as provided in Section 3.14. Frequency of sampling and profiling may be determined by the Port of Houston Authority.

<table>
<thead>
<tr>
<th>Analyses</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandblast Materials</td>
<td>Total Petroleum Hydrocarbons TX 1005</td>
</tr>
<tr>
<td></td>
<td>Total RCRS Metal (including nickel, vanadium pentoxide, and beryllium) EPA Method SW846-6020</td>
</tr>
<tr>
<td></td>
<td>*TCLP may be required</td>
</tr>
<tr>
<td>Soils, Sludges, etc.</td>
<td>BTEX EPA Method 8021 GC-MS</td>
</tr>
<tr>
<td></td>
<td>TPH TX 1005</td>
</tr>
<tr>
<td></td>
<td>Total RCRA Metal (including nickel, vanadium pentoxide, and beryllium) EPA Method SW846-6020</td>
</tr>
<tr>
<td></td>
<td>Total Volatile Organic Compounds EPA Method SW846-8260</td>
</tr>
<tr>
<td></td>
<td>Total Semi-Volatile Organic Compounds EPA Method SW846-8270</td>
</tr>
<tr>
<td></td>
<td>*TCLP may be required</td>
</tr>
<tr>
<td>Concrete, Asphalt &amp; Base Materials</td>
<td>Generator Knowledge Generator Knowledge</td>
</tr>
<tr>
<td></td>
<td>*If Generator knowledge is not available, use the Soil Testing Protocol.</td>
</tr>
</tbody>
</table>

Contractor shall provide the Port of Houston Authority with written notice of its activities sufficiently in advance, no less than 20 Working Days in advance of such activities, to permit the Port of Houston Authority to conduct such sampling and testing. Laboratory services obtained by the Port of Houston Authority are typically conducted on a standard 10 Working Day turnaround. Contractor shall not reuse any soil without prior written
acceptance by the Port of Houston Authority. The determination by the Port of Houston Authority of whether to allow reuse of soil pursuant to this Section 3.19 is within the sole discretion of the Port of Houston Authority. The Port of Houston Authority reserves the right to refuse to permit Contractor to use or reuse any soil.

3.20 **Use of Explosives:**

The use of explosives on Port of Houston Authority property is prohibited.

3.21 **Burning:**

Burning of materials or setting of any fires on Port of Houston Authority property is prohibited.

3.22 **Interference with Port of Houston Authority Operations and Navigation:**

The Contractor shall perform the Work in such a manner so as to not hinder the flow and navigation of ships, barges, cargoes and other vessels to and from the Port of Houston Authority’s facilities, so as to minimize interference with any other operation or work and so as to provide safe conditions at and around the Site.

Federal, state, U.S. Coast Guard and local statutes, laws, rules, regulations, ordinances, codes and rules of common law concerning navigation shall be complied with, and public advertisement, warning signs, buoys or other such requirements shall be complied with at the Contractor’s expense.

3.23 **Work On or Around Port of Houston Authority Grain Elevators:**

If any Project involves Work in or around grain elevators, special safety measures will be required. Any requirements for such Work will be set out in the Special Conditions.

3.24 **Work On or Around Railroad Tracks:**

If any Project involves Work on or around the Port of Houston Authority’s rail systems, special safety measures must be taken. Any requirements for such Work will be set out in the Special Conditions.

3.25 **Compliance with Security Laws and Regulations, etc.:**

(a) Contractor shall comply with (and cause its employees, Subcontractors, agents and other workforce to comply with) all applicable federal, state, local and Port of Houston Authority security rules and regulations and all applicable training and licensing requirements, including without limitation, the facility access regulations set from time to time by the Port of Houston Authority, all applicable rules and regulations of the Transportation Worker Identification Credential (“TWIC”) Program, and all requirements pertaining to the protection of “Sensitive Security Information” as set forth in 49 CFR 1520.

(b) Contractor shall ensure that all of its employees, Subcontractors and other persons needing unescorted access to secured areas of Port of Houston Authority facilities have obtained and have in their possession a valid TWIC when the TWIC Program is in force at Port of Houston Authority’s facilities. Contractor has the responsibility of ascertaining when such program is in force and causing itself, its employees, agents, Subcontractors and all others under its supervision or control to know and understand all TWIC regulations and comply with them. Contractor understands that Port of Houston Authority shall not have any duty whatsoever to provide TWIC escorts for Contractor, its employees, agents, Subcontractors and any others under its supervision or control.
(c) The Port of Houston Authority is not responsible for the cost of compliance for such rules, regulations and requirements. Contractor is required to obtain and be aware of all such rules, regulations and requirements, and represents to Port of Houston Authority that it is in compliance with these requirements.

(d) Contractor shall be fully liable for all damages, and for any fees fines and penalties assessed against the Port of Houston Authority (including without limitation, damages, fees, fines and penalties as a consequence of the issuance of a notice of violation, warning or other communication from the United States Coast Guard or other Governmental Authority) by reason of Contractor's (or its workforce's) failure to comply with any and all such rules, regulations and requirements. Contractor assumes full responsibility for such violation, warning or other communication and shall immediately notify the Port of Houston Authority in writing of Contractor's receipt of such notice, warning or other communication.

(e) Contractor assumes full responsibility for compliance by all persons under its control with the TWIC Program, and for assuring that such persons timely obtain a TWIC and have a non-revoked TWIC in their possession at all times while in secured or restricted areas of the Port of Houston Authority's facilities, all in accordance with applicable regulations.

(f) Contractor shall notify the Coast Guard and the Port of Houston Authority immediately in writing if any employee's, agent's or Subcontractor's TWIC is revoked, lost, damaged or stolen.

(g) Contractor shall sign such confidentiality agreements (and cause its employees, Subcontractors, agents and other workforce to do the same) as and when requested by the Port of Houston Authority with respect to information considered confidential and/or proprietary by the Authority.

(h) Contractor shall cause itself, its employees, Subcontractors, agents, and all others working under its control or supervision to know, understand and comply at all times with Port of Houston Authority's Credentialing Policy and Procedures as in effect from time to time.

(i) Prior to any employee or agent of Contractor (or any other person authorized by the Contractor) beginning work upon Port of Houston Authority property, Contractor shall obtain, and comply with, current Port of Houston Authority Credentialing Policy and Procedures. All personnel under the control of the Contractor, including Subcontractors, who will enter upon Port of Houston Authority property during the performance of the Work, shall be badged, and shall prominently display such badge, while on Port of Houston Authority property.

(j) IN ADDITION TO AND WITHOUT LIMITING ANY OTHER INDEMNITIES GIVEN BY THE CONTRACTOR UNDER THIS CONTRACT, CONTRACTOR SHALL DEFEND AND HOLD THE PORT OF HOUSTON AUTHORITY INDEMNITIES HARMLESS FROM ANY FAILURE OF CONTRACTOR, CONTRACTOR'S DIRECTORS, OFFICERS, EMPLOYEES, AGENTS, SUBCONTRACTORS, OR ANY OTHER PERSONS UNDER ITS CONTROL, SUPERVISION OR DIRECTION, TO OBSERVE ALL APPLICABLE TRANSPORTATION WORKER IDENTIFICATION CREDENTIAL (TWIC) LAWS AND REGULATIONS, OTHER SECURITY LAWS AND REGULATIONS, INCLUDING THOSE PERTAINING TO SENSITIVE SECURITY INFORMATION OR OTHER SECURITY INFORMATION DEEMED CONFIDENTIAL BY THE PORT OF HOUSTON AUTHORITY, AND ALL ACCESS REQUIREMENTS SET BY THE PORT OF HOUSTON AUTHORITY OR OTHER AUTHORITIES, AS WELL AS ALL OTHER REQUIREMENTS OF THIS CONTRACT, AND CONTRACTOR SHALL FULLY REIMBURSE PORT OF HOUSTON AUTHORITY INDEMNITIES AND MAKE THEM WHOLE ON ACCOUNT OF ANY DAMAGES, FINES, FEES OR PENALTIES ON ACCOUNT OF SUCH FAILURE.
SECTION 4. PROSECUTION OF THE PROJECT

4.01 General Obligation:

(a) The Contractor shall (i) supervise and direct the Work, using the Contractor's best skill and attention, in a good and workmanlike manner and in the best and most expeditious and economical manner consistent with the interests of the Port of Houston Authority, (ii) exercise the degree of care, skill and diligence in the performance of the Work in accordance with and consistent with industry standards for similar circumstances, (iii) utilize its best skill, efforts and judgment in furthering the interests of the Port of Houston Authority, (iv) perform the Work in strict compliance with Applicable Laws, such that the Project, no later than Substantial Completion, will comply with Applicable Laws, and (v) furnish efficient business administration and supervision (collectively, the "Standard of Care"), and perform the Work in accordance with the other requirements of the Contract Documents for the Contract Price and within the Contract Time. The Contractor shall not be relieved of its obligations to timely and properly perform the Work in accordance with the Contract Documents either (1) on account of activities or duties of the Port Contract Representative, Port Construction Representative, Inspectors, or Port of Houston Authority or consultant to the Port of Houston Authority relating to administration of the Contract, or (2) because tests, inspections, acceptances or approvals were required from or performed by a person other than the Contractor and such person did not timely perform such inspection or test or issue such acceptance or approval. No inspection or testing, failure to inspect or test, or acceptance or approval by a laboratory or Inspector shall be construed as an acceptance or approval of defective or nonconforming Work.

(b) Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, Equipment and Materials, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. All Equipment and Materials to be incorporated in the finished Work shall be new, of the highest quality and of the best grade of standard manufacture.

(c) The Contractor must perform at least twenty-five percent (25%) of the total dollar value of the portion of the Contract Price attributable to the Work performed in the field with its Own Forces. The existence and extent of such forces will be verified by certified payrolls submitted in accordance with the Prevailing Wage Scale section of the Contract Documents and as required under these General Conditions.

(d) The Contractor shall be responsible to the Port of Houston Authority for acts and omissions of the Contractor’s employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for or on behalf of the Contractor or any of its Subcontractors.

4.02 Independent Contractor:

It is agreed between the parties that the Contractor is and shall be an independent contractor. Nothing in the Contract Documents shall create a relationship of employer and employee, principal and agent, joint venture, or partnership between the Port of Houston Authority, on the one hand, and the Contractor or any of its employees, Subcontractors, Suppliers or agents of any thereof, on the other hand. Neither the Contractor nor any of its employees, Subcontractors, Suppliers or agents of any thereof, on the other hand. Neither the Contractor nor any of its employees, Subcontractors, Suppliers or agents of any thereof, on the other hand. Neither the Contractor nor any of its employees, Subcontractors, Suppliers or agents of any thereof, on the other hand. Neither the Contractor nor any of its employees, Subcontractors, Suppliers or agents of any thereof, on the other hand. As an independent Contractor, the Contractor: (a) assumes full responsibility for the safety of all persons employed or utilized by the Contractor or under the Contractor’s control and supervision; (b) shall maintain complete supervision and control over the Contractor's agents, employees, and Subcontractors; and (c) shall prosecute the Work at such time and seasons, in such order or precedence, and in such manner, using such methods as Contractor shall choose; provided, however, that in all instances Contractor shall and
the order, time, techniques, sequences, procedures, manner, means and methods of prosecution of the Work shall comply with the Contract Documents, including, without limitation, the Contractor’s Standard of Care and Contract Time, and Contractor shall have no right to perform any portion of the Work or utilize means, methods, techniques, sequences, procedures or individuals in violation of the Contract Documents or that may damage the Work or decrease the life expectancy of the Project. In no event shall the Port of Houston Authority have control over, charge of, or any responsibility for construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Port of Houston Authority in the Contract Documents and the exercise of any of the rights and authority granted the Port of Houston Authority in the Contract Documents (including, without limitation, ordering Changes in the Work, rejecting proposed means, methods, sequences or procedures, and directing suspension, rescheduling, re-execution or correction of the Work) shall not be construed as or deemed to be control of, charge of, or responsibility for or violation of Contractor’s responsibility for and rights with respect to such construction means, methods, techniques, sequences, procedures, safety precautions and programs. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the effectiveness, in light of the Standard of Care and other Contract provisions, and jobsite safety thereof and shall be fully and solely responsible for the effectiveness, in light of the Standard of Care and other Contract provisions, and jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be effective, in light of the Standard of Care and other Contract provisions, or may not be safe, the Contractor shall give timely written notice to the Port of Houston Authority and shall not proceed with that portion of the Work without further written instructions from the Port of Houston Authority.

4.03  Character and Conduct of Workmen:

The Contractor shall at all times furnish an adequate supply of qualified and legal workers and proper Equipment and Materials and enforce strict discipline and good order among its employees and other persons performing the Work. The Contractor shall not employ on the Work any person known to be unfit or any person known to be unskilled with respect to the task assigned to him. Only skilled Field Supervisors and workers shall be employed on work requiring special qualifications and skills. Common laborers are not skilled workers.

The Contractor shall only employ labor on the Project or in connection with the Work capable of working harmoniously with all trades, crafts, and any other individuals associated with the Project. The Contractor shall require the same of its Subcontractors and shall also use its best efforts to minimize the likelihood of any strike, work stoppage, or other labor disturbance.

At no time shall any individual engage in any illegal activities at the Site, consume at or bring alcoholic beverages onto the Site, or use illegal drugs at the Site. The Contractor shall remove from the Site any person who in the discretion of the Port Contract Representative commits trespass, is disorderly or otherwise engages in inappropriate or offensive conduct, harasses the Port of Houston Authority, its guests, employees or patrons, works in an unsafe manner, appears to be under the influence of alcohol or drugs, exhibits incompetence or is otherwise unsatisfactory. Such person or persons shall not be employed again on any portion of the Work. Contractor acknowledges and agrees that exercise of the Port of Houston Authority’s rights under this Section 4.03 shall not be the basis for any Claim, that Contractor will not assert or pursue and has no right to assert or pursue any Claim as a result of the exercise of the Port of Houston Authority’s rights under this Section 4.03, and exercise of the Port of Houston Authority’s rights under this Section 4.03 shall not entitle Contractor to any relief or recovery, whether for additional compensation, additional time, damages or otherwise.
4.04 **Cooperation with the Port of Houston Authority and Others:**

(a) The principal business of the Port of Houston Authority in the movement of cargoes will take precedence over all other considerations in conflicts of scheduling of operations including without limitation those operations of the Contractor. The Contractor shall cooperate with the Port of Houston Authority and with other contractors and each will so arrange its schedule such that the entire Work is completed most expeditiously.

The Port of Houston Authority shall have the right, but not the obligation, to assist the Contractor and any other party involved with the Project in scheduling Work. The Contractor shall not be entitled to assert a Claim for additional compensation (whether in the form of damages, an adjustment of the Contract Price or otherwise) or other relief or to a Change as a result of such Port of Houston Authority business operations, schedule adjustments and coordination; provided, however, that the foregoing shall not prevent the Contractor from seeking an extension of the Contract Time pursuant to Section 8.11.

(b) The Contractor understands and accepts that the Port of Houston Authority will have other contractors performing work on the Project or on Port of Houston Authority property. The Contractor shall cooperate with the Port of Houston Authority and such other contractors and coordinate its Work with the work of other contractors. Subject to Section 6, the Contractor shall make any revisions to the Baseline Schedule or Revised Baseline Schedule, as applicable, deemed necessary after a joint review and mutual agreement of the parties, and, if the result is an extension of the Contract Time, by a signed Change Order setting forth the agreed adjustment to the Contract Time. The resulting schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Port of Houston Authority until subsequently revised in accordance with Section 6.

The Contractor shall afford the Port of Houston Authority and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor’s construction and operations with theirs as required by the Contract Documents.

The Contractor shall be responsible for inspecting and accepting the work of any separate Port of Houston Authority contractor and determining whether such work is suitable to receive Contractor’s Work. The Contractor shall, prior to proceeding with any portion of the Work that requires proper performance of work by other Port of Houston Authority contractors, promptly report to the Port of Houston Authority any apparent discrepancies or defects in such other work that would render it unsuitable for such proper performance. Failure of the Contractor to so report shall constitute an acknowledgment that the Port of Houston Authority’s separate contractor’s completed or partially completed work is fit and proper to receive the Contractor’s Work.

The Contractor shall promptly remedy damage caused by the Contractor to completed or partially completed construction or to property of the Port of Houston Authority or separate contractors. Should the Contractor cause damage to the work or property of any separate contractor, the Contractor shall pay for all costs attributable thereto, including without limitation any costs associated with design professionals, and shall resolve any claims of any such other contractor immediately. IF SUCH SEPARATE CONTRACTOR SUES THE PORT OF HOUSTON AUTHORITY ON ACCOUNT OF ANY DAMAGE ALLEGED TO HAVE BEEN CAUSED BY THE CONTRACTOR, THE CONTRACTOR SHALL DEFEND AND INDEMNIFY THE PORT OF HOUSTON AUTHORITY INDEMNITEES PURSUANT TO SECTION 11.08.

If a dispute arises among the Contractor, separate contractors and the Port of Houston Authority as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Port of Houston Authority may clean up and allocate the cost among those responsible as the Port of Houston Authority determines to be reasonable.
(c) The Contractor agrees and acknowledges that it has no right to assert or pursue and may not make or enforce any Claim against the Port of Houston Authority based on any delay or interference caused by the failure of the Contractor to observe and perform its obligations of cooperation and coordination in accordance with this Section 4.04.

The Port of Houston Authority shall be reimbursed by the Contractor for costs incurred by the Port of Houston Authority which are payable to a separate contractor because of delays, improperly timed activities or defective construction of the Contractor. The Port of Houston Authority shall be responsible to the Contractor for costs incurred by the Contractor because of damage to the Work or defective construction of a separate contractor, so long as the Contractor complies with the requirements of Sections 4.04 and 8. Claims and other disputes and matters in question between the Contractor and a separate contractor shall be subject to the provisions of Section 8.

Contractor shall bear the costs attributable to its failure to comply with this Section 4.04, including without limitation all costs associated with design professionals or other consultants and costs of correction of the Work, and liable for all damages caused thereby.

4.05 Progress Meetings:

Contractor shall attend regularly scheduled progress meetings, which shall occur as frequently as required by the Port of Houston Authority, during which meetings the Port of Houston Authority, any Design Consultant or other Port of Houston Authority consultant, Contractor and Subcontractors may discuss such matters as Work procedures, progress, scheduling and coordination. Progress meetings shall be held at the construction field office or other location as designated by the Port Construction Representative.

Unless instructed otherwise by the Port of Houston Authority, Contractor shall prepare in advance of each such meeting a written agenda outlining the topics of discussion for such meeting, shall distribute copies thereof prior to the beginning of each such meeting, and shall be prepared to conduct such meetings. Such agenda shall include: (1) review of minutes of previous meetings; (2) review of Work, Progress Schedules, Submittals, pay estimates and payroll; (3) field observations, problems and decisions; (4) identification of problems which impede planned progress; (5) review of Schedule of Submittals and status of Submittals, including record drawings showing current as-built conditions; (6) review of RFI and Change Proposal status; (7) Change Order status; (8) review of off-site fabrication and delivery schedules; (9) maintenance of Baseline Schedule (or latest approved Revised Baseline Schedule); (10) corrective measures to regain Baseline Schedule (or latest approved Revised Baseline Schedule); (11) planned progress during succeeding work period; (12) coordination of projected progress; (13) maintenance of quality and Work standards; (14) effect of proposed changes on the Baseline Schedule (or latest approved Revised Baseline Schedule) and coordination; and (15) other items relating to the Work. The Contractor shall provide all information required during the meeting and be prepared to discuss each agenda item.

Unless instructed otherwise by the Port of Houston Authority, Contractor shall be responsible for taking accurate notes reflecting, to the satisfaction of the Port of Houston Authority, the minutes of such meetings and, within two (2) Working Days after each such meeting, Contractor shall distribute to the Port of Houston Authority, Design Consultant and any other attendees of such meetings, copies of such minutes, which shall at a minimum include a list of resulting action items, responsible parties and dates necessary to timely complete such action items such that the Contractor maintains the progress of the Work in accordance with the latest accepted Schedule.
4.06 **Additional Information:**

The Contractor shall respond to any questions and submit to the Port Construction Representative schedules, payrolls, reports, estimates and records, and such other data and information relating to the Work, Equipment and Materials, and Contractor’s performance of the Contract as the Port Construction Representative may from time to time require or request. Such data and information shall be submitted in such form and detail as the Port Construction Representative may direct.

4.07 **Drawings and Specifications Furnished by the Port of Houston Authority:**

The Contractor will be furnished the Drawings and Specifications in electronic form. Printing of the Drawings and Specifications as necessary for performance of the Work shall be the Contractor’s responsibility and shall be at the Contractor’s expense.

4.08 **Documents and Samples at the Site:**

The Contractor shall maintain one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record field changes and selections made during construction, and one record copy of accepted Shop Drawings, Product Data, Samples and similar required Submittals. These shall be available to the Port of Houston Authority and Design Consultant and other Port of Houston Authority consultants, if any, and shall be delivered to the Port of Houston Authority upon completion of the Work. The record copy of accepted Shop Drawings, Product Data, Samples and similar required Submittals, erection drawings and as-built drawings shall be kept at the Site. All other record documents also shall be kept at the Site, unless the Port Construction Representative expressly allows such records to be kept at another specified location.

The Contractor shall maintain daily logs in such detail and format as required by the Port of Houston Authority, which logs shall be available for the Port of Houston Authority’s and any Design Consultant’s or other Port of Houston Authority consultant’s review at any time during normal working hours, and which shall record the progress of the Work with emphasis on: (a) recording all actual as-built start and finish dates for all work activities identified on the Contractor’s base-line Project Schedule or the latest Revised Project Schedule, as applicable; and (b) recording all Work-related information pertaining to weather, injuries and accidents, Work re-performed, Subcontractors working on the Site, number of workers, any problems and/or delays experienced, including reasons therefore and corrective steps taken, and any other data as the Port of Houston Authority may require.

4.09 **Requests for Information:**

If the Contractor desires any information regarding the Work or the Project or information in respect of, any interpretation of, or direction with respect to a provision or requirement of the Contract Documents, then the Contractor shall prepare an RFI, setting forth in reasonable detail the matters as to which the Contractor desires such information or interpretation, and submit such writing to the Port Construction Representative. In situations in which a Design Consultant is utilized for this Project, the Contractor shall send the RFI to the Port Construction Representative and a copy of the transmittal letter to the Design Consultant and Inspector. The Port Construction Representative (or Design Consultant, if appropriate) shall review such RFI and issue an answer in response thereto, which response shall be final and conclusive as to the matters addressed therein.
If the Contractor believes that additional cost or time is involved or that it is entitled to a Change, any damages or other relief because of clarifications or instructions issued by the Port of Houston Authority in response to the Contractor’s notices or requests for information pursuant to this Section 4.09, the Contractor shall make Claims as provided in Section 8. If Contractor does not comply with Section 8, Contractor shall be deemed to have agreed that such clarifications or instructions do not entitle Contractor to any Change, additional time, additional compensation, other relief or damages and to have waived any right it might have to such Change, time, compensation, other relief or damages.

4.10 Submittals to be Furnished by the Contractor after Award:

(a) The Contractor shall prepare, or cause to be prepared, and submit to the Construction Manager (or such other individual specified in the Contract Documents as responsible for reviewing a specific Submittal) for review, complete design and detailed Shop Drawings, Product Data, Samples and other pertinent information showing all Equipment and Materials and details of Work to be incorporated into the Project and such other matters as requested by the Port Contract Representative or required by the Contract Documents. In instances in which the Contract Documents provide for a Submittal to be provided directly to someone other than the Construction Manager, Contractor shall provide a copy to the Construction Manager of such Submittal.

All Submittals shall be delivered to the Construction Manager no later than ninety (90) calendar days after the Start Work Date, unless specifically waived or extended by the Port Construction Representative.

No portion of the Work requiring Submittals shall be performed and no Equipment and Materials shall be ordered or fabricated before review of and a response permitting Work based on the applicable Submittals by the Construction Manager.

(b) Within ten (10) Working Days after the Contractor has been notified of the award of Contract, the Contractor shall prepare for the Construction Manager’s acceptance, a Submittal Schedule (“Schedule of Submittals”) which is coordinated with the Baseline Schedule or Revised Baseline Schedule, as applicable, and allows the Construction Manager and Design Consultant, if applicable, reasonable time to review Submittals. Such Schedule of Submittals shall be in a form acceptable to the Construction Manager. At a minimum, the Schedule of Submittals shall include all Submittal items and packages that are required by the Contract Documents and shall indicate all proposed submittal dates and all proposed response dates from the Port Authority in order for the Contractor to maintain a critical path Baseline Schedule that meets all Milestones deadlines and the Contract Time. Contractor shall and keep current the Schedule of Submittals during the performance of the Work.

Submission of Submittals shall be made sufficiently in advance of Contractor’s need for the work covered by such Submittals so that all persons reviewing the Submittal have a reasonable amount of time to review the Submittal, taking into account the nature and number of Submittals, and so as to maintain the orderly progress of the Work, but in no event less than 20 days prior to the time that Contractor expects to incorporate the work covered by such Submittal into the Work. Contractor understands and acknowledges that additional time may be required for review by any Design Consultant or other consultants to the Port Authority and Contractor shall provide for such additional time in making its Submittals. Moreover, submission of Submittals shall be made in such sequence that the persons reviewing such Submittals will have all of the information necessary for such review.

The Contractor will not be entitled to any extension of time or other relief due to a delay associated with Contractor’s failure to submit Submittals in sufficient time for review by the Construction Manager and, where required, Design Consultant and others.
(c) Submittals are not and, notwithstanding any review and acceptance thereof by the Port of Houston Authority or any Design Consultant, shall not be construed to be Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to perform the Work in conformance with the Contract Documents, including how it intends to conform to the information given and the design concept expressed in the Contract Documents.

The Port of Houston Authority and/or Design Consultant will review and accept, reject or take other appropriate action upon the Contractor’s Submittals but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The purpose of review and acceptance of Submittals by the Port of Houston Authority and/or Design Consultant is merely an effort on the part of the Port of Houston Authority to determine whether the Contractor is complying with the requirements of the Contract Documents and shall in no way operate as a waiver of any right of the Port of Houston Authority or any obligation of Contractor hereunder, nor in any way relieve Contractor of any of its obligations hereunder, including, without limitation, its responsibility for proper functioning, fit and conformity with the Contract Documents. Review and acceptance of Submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of Equipment and Materials or systems, or for ensuring the adequacy of a plan or compliance with Applicable Laws, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Port of Houston Authority’s and/or Design Consultant’s review and acceptance of the Contractor’s Submittals shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences or procedures. The Port of Houston Authority’s and/or Design Consultant’s review and acceptance of a specific item shall not indicate review and approval of an assembly of which the item is component.

(d) Submittals shall be reviewed, approved, checked, stamped indicating approval by the Contractor and compliance with the Contract Documents, and signed by the Contractor before being submitted for review as set forth herein. The Contractor shall be solely responsible for the accuracy and correctness of Submittals whether furnished by Contractor or by others. Contractor’s submission of Submittals to the Construction Manager shall constitute Contractor’s representation, with respect to each Submittal, that Contractor has determined and verified all Equipment and Materials, field measurements and field construction criteria related thereto, that Contractor has checked and coordinated the information contained within such Submittal with the requirements of the Work and the provisions of the Contract Documents, and that such Submittal satisfies all such requirements and provisions. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Construction Manager without action.

The Contractor shall provide professional services which constitute the practice of architecture or engineering as required by the Contract Documents for the Work or as the Contractor needs to provide such services in order to carry out the Contractor’s responsibilities for construction means, methods, techniques, sequences and procedures. If professional design services or certifications by a design professional related to systems, Equipment and Materials are required of the Contractor by the Contract Documents, the Contractor shall cause such services or certifications to be provided by a properly licensed design professional, licensed in the State of Texas, acceptable to the Port Contract Representative, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such professional. Submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional’s written approval when submitted to the Construction Manager. The Port Authority and Design Consultant shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications and approvals performed by such design professionals.
(e) The person reviewing Submittals will return them to the Contractor marked to indicate whether the Contractor may proceed with the Work based on the Submittal as is or with specified changes, whether the Contractor must make changes to the Submittal and resubmit it, or whether the Submittal is rejected and the Contractor must submit another Submittal. Informational Submittals upon which the Construction Manager, Design Consultant or others are not expected to take responsive action may be so identified in the Contract Documents, but nothing shall preclude review and action upon any such Submittal. Submittals which are not required by the Contract Documents may be, but are not required to be, returned without action.

The Work shall be in accordance with accepted Submittals, except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Construction Manager’s (or, Design Consultant’s) review, acceptance or approval of Submittals unless the Contractor has specifically informed the Construction Manager in writing of such deviation at the time of submittal and a Change Order or Construction Change Directive has been issued expressly authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Submittals by the Construction Manager’s (or, Design Consultant’s) approval or acceptance thereof.

Submittals marked indicating that there are no exceptions, that the Submittal is accepted as submitted, or is accepted with noted corrections may be used for performance of the Work and fabrication prior to the reviewer’s further review, unless specific instructions are given otherwise by such reviewer. Submittals marked in any other manner, including those indicating that they must be resubmitted for any reason, may not be used by the Contractor for the Work, whether for activities on the Site or fabrication off the Site, prior to the reviewer’s further review and acceptance. The time required for revision and/or resubmission of Submittals shall not entitle the Contractor to any extension of time or other relief.

The Contractor shall make the necessary changes to Submittals returned and marked indicating that changes are required and, with respect to such returned Submittals, within five (5) working days (or sooner so as not to delay the Work) following receipt of any queries or comments, submit revised Submittals for another review following the same procedure as set forth above. The Contractor shall call the reviewer’s specific attention to, in a writing attached to or by writing on such resubmitted Submittals, any revisions other than those required by the reviewer pursuant to a prior review. In the absence of such written notice, acceptance of a resubmission shall not apply to such revisions.

All notes referenced on “Approved as Noted” or “Exceptions as Noted” or similar responses to the Contractor shall be completed, fulfilled and/or acknowledged in writing, as applicable, to the Construction Manager, within five (5) calendar days of receipt of the “As Noted” response to the Contractor.

If at any time before Final Completion of the Work Changes are made that necessitate revising reviewed Submittals to reflect the impact of the Change, then the Contractor shall make such revisions and resubmit the affected Submittals to the reviewer, following the same procedure set forth above, for additional review, such review to be conducted prior to effecting the Changes involved. In the event Contractor desires to proceed other than as reflected in an accepted Submittal, Contractor shall make revisions to and resubmit the affected Submittals to the reviewer, following the same procedure set forth above, for additional review, such review to be conducted prior to Contractor proceeding other than in accordance with the accepted Submittal.

(f) In the event Contractor believes any markings on or decisions of the Construction Manager (or Design Consultant or other reviewer) regarding any Submittal is inconsistent with or would constitute a Change or compliance with any such marking or decision would entitle Contractor to additional time (whether in the form of an adjustment to the Contract Time, relief from its obligation to perform within the Contract Time or by any Milestone, or otherwise), additional compensation (whether in the form of damages, an adjustment to the Contract Price or otherwise) or other relief, Contractor shall
assert a Claim in accordance with Section 8. If Contractor does not comply with Section 8, Contractor shall be deemed to have agreed that such markings and decisions do not entitle Contractor to any Change, additional time (whether in the form of an adjustment to the Contract Time, relief from its obligation to perform within the Contract Time or by any Milestone, or otherwise), additional compensation (whether in the form of damages, an adjustment to the Contract Price or otherwise) or other relief and to have waived any right it might have to any such Change, additional time, additional compensation, or other relief.

(g) Unless the Port Construction Representative instructs the Contractor otherwise, Contractor shall transmit each Submittal to the Construction Manager through Microsoft Office Sharepoint Server ("MOSS"). The transmittal shall include the date and Submittal number; Project title and number; the names of the Contractor, Subcontractor, Supplier and manufacturer; identification of product or material being supplied; location where product or material is being installed; and the Specification Section number. Identification of deviations from Contract Documents must be clouded on submitted drawings, and itemized and detailed on a separate 8 1/2” x 11” sheet titled “DEVIATIONS FOR ____________.” If no deviations exist, this sheet must state so. All design deviations must be signed and sealed by a Professional Engineer who is licensed in the State of Texas. Transmittals will be numbered automatically by the MOSS system. Each Submittal shall only contain one type of Work, Material, or Equipment. Mixed Submittals will not be accepted.

When required in the Specifications, the Contractor shall submit the manufacturer’s certificate of compliance for review by the Construction Manager. Certificates may be recent or previous test results on material or product, subject to the approval of the Port Construction Representative.

The Port Construction Representative, Design Consultant and Contractor shall be responsible for obtaining their own copies of Submittals for office and/or field use. The Contractor shall be responsible for furnishing Subcontractors and Suppliers with all Submittals as may be necessary for the coordination of the activities of all Subcontractors and Suppliers.

Each Shop Drawing shall be labeled to show such drawing was prepared by or for the Contractor and shall be identifiable by serial numbers and a descriptive title thereon. The seal of a Registered Professional Engineer, licensed in the State of Texas, shall be affixed to each Shop Drawing when such Shop Drawing reflects an engineering design. Shop Drawings shall accurately and distinctly show field and erection dimensions; arrangement and section views; relation to adjacent materials or structures, including complete information for making connections between Work under this Contract and work under other contracts; kinds of materials and finishes; parts list and descriptions; assembly drawings of equipment components and accessories showing their respective positions and relationships to the complete equipment package; and where necessary for clarity, identify details by reference to drawing sheet and detail numbers, schedule or room numbers as shown on the Contract Drawings. Shop Drawings shall be to scale, providing a true representation of the specific equipment or item to be furnished. In addition, Contractor shall submit CADD files for each Shop Drawing.

The Contractor shall mark each copy of submitted Product Data to identify applicable products, models and options to be used in this Project. The Contractor shall also supplement manufacturers’ standard data to provide information unique to this Project, where required by the Specifications. For products specified only by reference standard, the Contractor shall provide product manufacturers, trade name, model or catalog designation and applicable reference standards.

All Samples shall be reviewed and signed by a Licensed Professional Engineer, licensed in the State of Texas, acceptable to the Port Contract Representative. All samples shall be provided in such form as required by the Specifications.
(h) If, after execution of the Contract and prior to submittal of applicable Shop Drawings or other Submittal, the Contractor desires to submit an alternate product or method in lieu of what has been specified or shown in the Contract Documents, the Contractor may do so in writing setting forth the following:

1. Full explanation of the proposed substitution and submittal of all supporting data, including technical information, catalog cuts, warranties, test results, installation instructions, operating procedures, and other like information necessary for a complete evaluation of the substitution; and

2. Basis for substitution.

If the Port Contract Representative and Contractor agree to the substitution, such agreement shall be considered a representation by Contractor that (1) the proposed substitution conforms and meets all the requirements of the pertinent Specifications and requirements of the Contract Documents and as shown on the Drawings and required by the Project, and (2) the Contractor accepts the warranty and correction obligations in connection with the proposed substitution as if originally specified by the Port of Houston Authority. In the event that any substitution, including design Changes, is accepted by the Port Contract Representative or is deemed to have been accepted by the Port of Houston Authority or Port Contract Representative in a court of law, the Contractor shall assume responsibility for and pay for: (a) any and all additional costs pertaining to any redesign and adverse consequences of such redesign; (b) any and all costs of replacement, corrections or adjustments to the Work, adjoining Work and the Port of Houston Authority’s existing property; and (c) any and all costs or damages arising from adverse impacts to the critical path of the Baseline Schedule, or the latest accepted Revised Baseline Schedule, and/or any delays in the Contract Time arising out of such substitution. Proposals for substitution shall be submitted in triplicate to the Construction Manager in sufficient time to allow the Construction Manager no less than twenty (20) Working Days for review. No substitutions will be considered or allowed without the Contractor’s submittal of complete substantiating data information and stated here and before.

Substitutions and alternates may be rejected without explanation and in the sole discretion of the Port of Houston Authority.

4.11 Allowances:

(a) The Contract Price includes all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Port of Houston Authority may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection. Equipment and Materials under an allowance shall be selected by the Port of Houston Authority in sufficient time to avoid delay in the Work, provided that the Contractor informs the Port of Houston Authority of the deadline for a decision in sufficient time for the Port of Houston Authority to make a timely decision. Contractor shall not start or purchase any Work specified to be accomplished under an allowance until Contractor submits firm prices for the Work to the Port Contract Representative and the Contractor receives from the Port Contract Representative written instructions to proceed with the Work.

(b) Unless otherwise provided in the Contract Documents:

(i) allowances shall cover the cost to the Contractor of Equipment and Materials delivered at the Site and all required taxes, if any, less applicable trade discounts;

(ii) Contractor’s costs for unloading and handling at the Site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Price but not in the allowances;
(iii) whenever costs are more than or less than allowances, the Contract Price shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (a) the difference between actual costs and the allowances under Section 4.11(b)(i) and (b) changes in Contractor's costs under Section 4.11(b)(ii).

4.12 As-Built Drawings and O&M Manuals:

(a) Contractor shall maintain at the Site one set of Drawings showing as-built conditions (including without limitation any conditions discovered to be at variance with the information as indicated on the original Drawings), locations and details of any and all Work which is installed under this Contract. Such set shall include mark ups of the latest issued Drawings and shall indicate actual locations of utilities and all Changes in the Work which occurred during the course of the construction. Two (2) hard copy sets of Drawings and Specifications with neat and legible as-built drawings (indicating Changes in red) shall be returned to the Port Contract Representative within thirty (30) days following the final inspection. Such “as-built” drawings shall be certified by Contractor as accurately and completely depicting the Project as the completed work and shall be reproducible.

In addition, Contractor shall provide one complete set of white background prints of all plumbing, mechanical and electrical Drawings, and all other systems requiring concealed piping, conduit or utilities which form a part of the Work. Immediately after such Work is installed, the Contractor shall carefully draw on these prints, in red ink, the as-built condition of any and all Work which is installed under this Contract. In marking such as-built conditions, Contractor shall indicate by measured dimension to building corners or other permanent monuments, exact locations of all piping, conduit or utilities concealed in concrete slabs, behind walls, within ceilings or below grade. Such prints shall also indicate exact locations of valves, pull boxes and similar items as required for maintenance or repair service.

(b) The Contractor shall, at the end of the job, make all corrections to the tracings or other applicable documentation of its Submittals so that they reflect the finished Work as built and shall deliver to the Port Contract Representative either the tracings or reproducible prints thereof on translucent paper. All Shop Drawings and erection drawings reflecting as-built conditions shall be provided to the Port Contract Representative in the current version of CADD as well as in hard copy.

(c) Prior to Final Completion, Contractor shall prepare and provide operations and maintenance manuals for the items as listed in the Specifications. Contractor shall arrange items that are related in their operation and maintenance needs together. Contractor will be required to submit, in an outline format, its intended arrangement of required items for review and acceptance by the Port Contract Representative prior to producing the manuals. In addition, Contractor shall submit each O&M manual in a PDF Binder Portfolio format for review and approval by the Port Contract Representative. The Port Contract Representative shall have sole discretion of acceptance of O&M manual contents and composition.

Upon approval of the O&M manual, the Contractor shall submit six (6) complete hard copy sets of each approved O&M manuals. Final approved copies to be bound 4:1 plastic Coil Binding, 8.75” x 11.25” oversize (35mil) Blue Polyethylene Covers, each section shall be divided by 90# Double Reverse Collated Index Tabs printed on both sides. With an 8”x11” polypropylene CD sleeve insert at the back of each manual to insert the finalized manuals on CD.

The O&M manual shall be professionally composed and complied and shall not be an assembly of cut sheets. Each page of the O&M manual shall be numbered sequentially.
The contents of the O&M manuals shall be generally organized as follows:

- **Introduction**: Introduces the reader to the facility. Outlines the structure, content, how to use the manual, and includes a brief outline of the various systems covered. In addition, this chapter contains a list of emergency contacts and a list of supplementary material available on the facility such as:
  - Design/Construction Specifications
  - Submittals File
  - Completion Report
  - As-built Drawings
  - Materials List
  - Certified Tests and Reports
    - Civil/Sanitary
    - Mechanical/HVAC
    - Electrical

- **Safety Data**: Safety hazards commonly associated with the operation of system/equipment applicable to the facility are identified and their prevention is discussed.

- **Utility Systems**: Discusses the various site utility systems that interface with the facility. These include water supply systems, sanitary waste, electrical, natural gas, communications, security, and storm water, etc.

- **Building Interior & Exterior**: Includes housekeeping and general maintenance of the facility. The importance of conduction and annual inspection is discussed together with record keeping forms for conducting the inspections.

- **Plumbing**: O&M of the domestic water and sanitary waste systems.

- **Fire Protection**: O&M of the fire protection wet/dry pipe sprinkler systems.

- **Heating, Ventilating & Air Conditioning (HVAC)**: O&M of the building's HVAC systems, including automated controls and exhaust, space heating, and central air systems.

- **Fire Detection & Intrusion Alarms**: O&M of fire detection and intrusion detection and alarm systems (wet/dry pipe sprinkler).

- **Electrical**: O&M of power distribution equipment and backup/emergency electrical systems (uninterruptible power supply, generator).

- **Conveying Systems**: General information and preventive maintenance for elevators, escalators, wheelchair lifts, conveyors, etc.

- **Other Systems Based on Facility Requirements**: General information and preventive maintenance requirements for other systems and equipment not already identified.

- **Operating Logs**: General information and instructions for using maintenance log forms. A listing of maintenance tasks with their recommended frequencies of performance is included.

- **Maintenance Charts**: Maintenance charts include maintenance frequency checklists, maintenance summary, lamp replacement data sheet, equipment data sheets, recommended maintenance and service contacts, and a recommended work order form.
• **Manufacturers’ Literature**: Identifies manuals, cut sheets, etc., from equipment manufacturers that amplify information provided within the system-level O&M manual. Manufacturers’ literature generally provides procedures to operate, maintain, troubleshoot, and repair specific items at the equipment level. This information is contained in a separate volume of binders, identified by facility/system, for easy reference. Specific material or complete documents can also be electronically scanned for its 'on-line' use, such as linking from the system-level manual.

• **Description - System-Level**: Description of the system and its purpose, how it operates, and any interfaces it may have. A table can provide overall system design criteria, i.e. flow, pressure, temperature, capacity, power requirements, etc.

• **Operating Procedures - Controls/Start-up/Shutdown/Emergency Over-Ride/Seasonal Changeover**: Operating instructions include equipment configurations for each mode of operation, e.g. valve positions, control settings, intended operating strategies, and break-in procedures.

• **Problems and Solutions - Troubleshooting**: System-level troubleshooting tables guide maintenance personnel, via fault tree analysis, in a sequential, step-by-step isolation of a system problem to identify faulty equipment. Typical malfunctions, tests or inspections, and corrective actions or recommendations to correct malfunctions are included.

• **Preventive (Planned) Maintenance (PM) - Procedures/Intervals**: Maintenance tasks are developed for equipment that comprises the system. Preventive and corrective maintenance is discussed. Scheduled intervals (e.g., daily, weekly, monthly, etc.) are determined and assigned to PM tasks to maximize systems run time, thereby reducing corrective maintenance tasks.

### 4.13 Progress Photographs:

Within the last three (3) days of each calendar month, the Contractor shall have taken by a professional photographer four (4) separate photographic views of the Project as directed by the Port of Houston Authority’s Inspector, which photographic views shall show the status of the Work as of the dates taken. By the first day of the following month, two 8 inch by 10 inch enlargements of each such photographic view (for a total of eight (8) such enlargements) shall be delivered to the Port of Houston Authority’s Inspector, along with a copy of the digital file for each such view. All photographs shall be in color and shall be of high resolution, clarity and sharpness, in digital format sufficient produce 8 inch by 10 inch enlargements with a minimum resolution of 300 dots per inch (dpi). Such digital files shall not be resized, cropped, touched-up, or otherwise manipulated. The name and address of such photographer shall appear on the reverse side of each printed photograph. The face of each such enlargement shall be annotated with the name of the Contractor, the name of the Project, the view and the date on which the photographs were taken. The Port of Houston Authority shall be the sole judge of the quality of the finished product.

### 4.14 Lines and Grades:

The Port of Houston Authority will establish base lines and benchmarks for control with respect to alignment and elevation of Work. The Contractor shall provide and maintain accurate lines and grades at all times. The Port of Houston Authority may, but is not obligated to, check lines and grades periodically and may pursuant thereto advise the Contractor of any errors found, and the Contractor shall immediately correct any such errors; provided, however, that the Contractor shall be solely responsible for the accuracy of the Work and its conformance to the Contract Documents. In the event that the Port of Houston Authority is required reestablish such base lines and benchmarks due to the Contractor’s failure to comply with the Standard of Care, the Contractor shall be responsible for the cost to the Port of Houston Authority of reestablishing such base lines and benchmarks. The Contractor (or its surety) shall
pay such cost to the Port of Houston Authority upon demand by the Port of Houston Authority, or, at its option, the Port of Houston Authority may withhold from the Contractor or its surety or offset such cost against any amount due to the Contractor or its surety under the Contract or otherwise under Applicable Law.

4.15 Installation of Mechanical and Electrical Work:

The Contractor shall verify that utility requirement characteristics of operating Equipment are compatible with existing or planned utilities. The Contractor shall coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. The Contractor shall follow routing shown for pipes, ducts and conduit, as closely as practicable, place runs parallel with the line of buildings and utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs. Further, the Contractor shall conceal pipes, ducts and wiring within the construction in finished areas, except as otherwise indicated, and shall coordinate the locations of fixtures and outlets with finish elements.

4.16 Parking, Security of Work, Storage and Related Matters:

The Contractor shall arrange for and provide parking for all individuals providing Work at the Site and any off-Site storage for Equipment and Materials.

Equipment and Materials for use in the Work shall be stored at the Site in such a manner that prevents damage and deterioration. Equipment and Materials that have been damaged or in any way become unfit for use will not be accepted in the Work.

Prior to Final Completion of the Work, all unused Equipment and Materials and storage facilities shall promptly be removed by the Contractor.

4.17 Cutting and Patching:

The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Port of Houston Authority or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Port of Houston Authority or a separate contractor except with written consent of the Port of Houston Authority and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Port of Houston Authority or a separate contractor the Contractor’s consent to cutting or otherwise altering the Work.

4.18 Material Furnished by the Port of Houston Authority:

If any Equipment and Materials is to be furnished by the Port of Houston Authority, a listing of all such Equipment and Materials will be set out in the Special Conditions. The Contractor shall be responsible for receiving such Equipment and Materials, other than those which are specified to be received by the Port of Houston Authority. The Contractor shall be responsible for unloading, securing, and installing all such Equipment and Materials. Contractor will promptly notify the Port of Houston Authority, in writing, of any delivery of such Equipment and Materials. Contractor shall perform the Work in such a manner so as to preserve any and all guarantees and warranties associated with such Equipment and Materials.
4.19 **Equipment and Materials Furnished by the Contractor:**

The Contractor shall provide and use accepted Equipment and Materials in sufficient qualities and quantities to facilitate diligent prosecution of the Work to the end that the Work will be completed within the Contract Time and otherwise in accordance with the Contract Documents. If at any time the Equipment and Materials being used, in the opinion of the Port Construction Representative, are faulty or inadequate, or will prevent the Work from being completed in accordance with the Contract Documents or within the Contract Time, such Equipment and Materials shall be replaced or supplemented with Equipment and Materials satisfactory to the Port Construction Representative.

4.20 **Water for Construction:**

Water for construction purposes may or may not be available from the Port of Houston Authority’s fire hydrants. Whether water will be available from such hydrants will be stated in the Special Conditions. If available, Contractor shall use only reasonable amounts and must install a meter and utilize appropriate backflow protection (i.e., air gap or reduced pressure backflow assembly). The Contractor shall furnish all temporary connections therefor at its own cost. Unless stated otherwise in the Special Conditions, the Contractor shall not be charged for water provided by the Port of Houston Authority and utilized by the Contractor in accordance with the Standard of Care.

4.21 **Electrical Connections:**

The Contractor shall make its own arrangements and pay for electrical service at the Site unless otherwise stated in the Special Conditions.

4.22 **Contractor’s Obligation to Maintain a Clean Work Site:**

The Contractor shall at all times during the Contract Time maintain the Site and structures in such a manner that eliminates accumulations of waste materials, debris or rubbish. The Contractor shall perform daily clean-up of dirt, debris, scrap materials, and other disposable items outside the construction zone. At the end of each week, the Contractor shall remove from and about the Site waste materials, rubbish, and any of the Contractor’s tools, construction equipment, machinery and surplus Equipment and Materials that could cause a hazard. Prior to Final Completion of the Work or such sooner time as may be required by the Port of Houston Authority, the Contractor shall completely remove from the Site all waste matter, rubbish and debris as well as all unused materials, temporary facilities, tools and the like, leaving the area “broom clean.” Any Hazardous Substances must be disposed of in accordance with Section 3.13.

Littering or contributing to poor housekeeping, unsanitary or unsafe conditions or other disruptive procedures in the Port of Houston Authority’s facilities or on the Port of Houston Authority’s property is strictly prohibited. The Port of Houston Authority reserves the right to cease all Work that may be disruptive.

If Contractor fails to maintain the Site as required and fails to timely complete appropriate clean up and removal activities prior to Final Completion or within twenty-four (24) hours after the Port of Houston Authority’s direction to do so, the Port of Houston Authority shall have the right (but not the obligation) without further notice to the Contractor to perform such clean up and removal activities at Contractor’s expense and to offset, pursuant to Section 10.15, the amount so expended by the Port of Houston Authority against any amounts due the Contractor or its surety or recover such amount from either of them.
The Contractor shall ensure that trucks which have delivered Equipment and Materials to the Contractor, including without limitation concrete trucks, shall be cleaned either: (1) at a location within the Site designated by the Port Construction Representative, or (2) off the property of the Port of Houston Authority. At a time convenient to the Contractor but prior to Final Completion, any residue from such cleaning operations shall be completely removed from the property of the Port of Houston Authority.

4.23 Quality Control:

(a) The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work. Contractor shall employ such practices as are necessary to protect all completed and partially completed Work and all existing improvements located on the Site from loss and damage, including from subsequent operations of the Contractor or later to be performed Work, theft or damage by weather and, if necessary, shall provide suitable shelter therefore. Contractor shall correct at its own expense any damage or disfigurement to work or property (whether or not located on the Site) resulting from the fault, neglect or omission of Contractor, any Subcontractor, or any other person or entity for whom any of them is legally responsible.

(b) Contractor shall develop and implement a system and procedures for reviewing its own Work and the Work of its Subcontractors of every tier for defects and deficiencies, including the preparation of all appropriate quality control documentation, to assure that all such defects and deficiencies are discovered and corrected. Contractor shall submit its quality control plan to the Port of Houston Authority for review and comment. Such quality control plan shall set forth Contractor’s staffing plan for quality control, including the individual on Contractor’s staff in charge of quality control (which individual shall be subject to acceptance of the Port of Houston Authority), arrangements for independent testing and reporting, and such other information as required by the Contract Documents and the Port of Houston Authority.

4.24 Material Testing and Craftsmen Qualifications:

(a) The testing and inspection of Equipment and Materials as required by the Specifications, or as deemed advisable by the Port Construction Representative unless provided otherwise herein, shall be performed by a commercial laboratory hired by and paid directly by the Port of Houston Authority.

The Contractor shall cooperate with such laboratory to ensure that all required testing is accomplished without delay to or interference with the Work. The Contractor at its own expense shall provide such laboratory with all test specimens required by the Contract Documents. The Contractor shall provide the Construction Manager and Inspectors with at least 24 hours advance written notice of the time and place when all tests and inspections will be performed such that the Inspectors may arrange for such testing by such laboratory and, at their discretion, observe such tests and inspections. To the extent the costs payable by the Port of Houston Authority for testing or observation of testing increase because of actions or inactions of the Contractor, including any failure to comply with the Standard of Care or to complete the Work within the Contract Time, Contractor shall be liable for such increase. The Port of Houston Authority may recover such increase from Contractor or its surety, or offset it from amounts due to Contractor, or its surety, from the Port of Houston Authority.

Such laboratory shall perform tests required for concrete work, shall test earth fill material for compliance with the Specifications and for optimum moisture content, shall make density tests of compacted fill and shall perform any other material tests the Port Construction Representative directs. All certificates of such testing, inspection or approvals issued by such laboratory shall be delivered to the Inspector with a copy to the Contractor.
(b) The costs of laboratory services required to establish mix designs for Portland Cement concrete shall be borne by the Contractor. The Contractor shall pay for the costs of analyzing aggregates, fixing gradations, preparing and testing of design cylinders or specimens and other such services required to establish mix design, or to redesign any mix when required due to any change in source of materials or other conditions.

(c) The expense of tests necessary to qualify and craftsmen, including welders, shall be borne by the Contractor.

4.25 Observation of and Access to the Work; Inspections by the Port of Houston Authority; Test Cuts:

(a) The Contractor shall provide the Port of Houston Authority and any Design Consultant or other Port of Houston Authority consultant (and any governmental representatives who may lawfully request access to the Work) access to the Work in preparation and progress wherever located. All Equipment and Materials furnished and Work performed shall be subject to rigid inspection. The Port Construction Representative, Construction Manager and the Inspectors shall at all times have access to all parts of any facility where Equipment and Materials is being manufactured. The Port Construction Representative shall have full control of all matters concerning such inspections and its decision as to such matters shall be final.

(b) The Port of Houston Authority reserves the right to observe and inspect the Work at any time. The presence of the Port of Houston Authority, Design Consultant or any other consultant to the Port of Houston Authority at the Site or other Work location does not imply concurrence with, acceptance of or approval of the Work. The Contractor shall call specific items to the attention of the Port of Houston Authority if Contractor wishes to obtain the Port of Houston Authority’s opinion.

(c) Portions of the Work that are performed in stages must be inspected at each stage of such Work. If the Contractor proceeds with such Work without timely calling for an inspection at each such stage, the Contractor does so at its own risk and shall be responsible for all costs of every nature attributable thereto, including without limitation any costs associated with design professionals, and liable for all damages caused thereby. The Port of Houston Authority shall have the right, but not the obligation, to require the Contractor to break out or otherwise uncover any such Work for proper inspection. Repair or replacement of Work uncovered or broken out must be performed at the sole expense of the Contractor.

(d) Prior to Contractor covering any Work, Contractor must provide written notice sufficiently in advance thereof such that the Port of Houston Authority shall first have the opportunity (but not the obligation) to inspect such Work prior to such covering. Such notice shall not be less than 24 hours. Moreover, the Port Contract Representative has the right, when it deems necessary, to make test cuts at any place that the Port Contract Representative desires to determine the conformity of the Work, including without limitation any Equipment and Materials, workmanship or dimensions, with the Contract Documents. If the Work is found to comply with the Contract Documents, the Port of Houston Authority will bear all costs incurred by such test cut and test. If the Work is found not to comply with Contract Documents, the Contractor shall bear all cost incurred by such test cut and test and all cost necessary to bring the Work into compliance with the Contract Documents, including without limitation costs associated with design professionals and other consultants.

(e) The Contractor shall sign and acknowledge all Inspector reports.

(f) Whenever the Contractor is permitted to do work at night, on weekends, or on holidays, or is permitted to vary the period during which Work is normally conducted, the Contractor shall give the Port Construction Representative twenty-four (24) hours written notice prior to beginning such Work.
that such Work may be observed and inspected. Contractor shall perform such Work without extra compensation to the Contractor and in compliance with regulations furnished in writing by the Port Construction Representative.

4.26 **Intellectual Property Rights:**

If the Contractor uses any design, Equipment and Materials, or process covered by Intellectual Property Rights, letters patent or copyright of any third party, the Contractor shall lawfully acquire the right to such use from the appropriate owner thereof. Pursuant to Sections 11.08 and 11.09, THE CONTRACTOR SHALL INDEMNIFY AND SAVE HARMLESS THE PORT OF HOUSTON AUTHORITY INDEMNITEES FROM ANY AND ALL CLAIMS OF INFRINGEMENT BROUGHT BY ANY THIRD PARTY BASED UPON, ARISING OUT OF OR RELATING TO ANY SUCH USE.

4.27 **Contractor’s Field Supervisor:**

The Contractor shall have at all times during which the Work is in progress a competent and reliable English-speaking representative on the Site (Contractor’s “Field Supervisor”). In the event Contractor is working multiple shifts, Contractor may utilize a separate Field Supervisor for each shift. In such an event, the Contractor shall notify the Port of Houston Authority in writing which Field Supervisor will be the Contractor’s representative primarily responsible for the Work. Each Field Supervisor shall be in the direct employ of the Contractor and shall be subject to the acceptance of the Port of Houston Authority. No Subcontractor shall perform any Work at the Site unless the designated Field Supervisor is present. The name, address, home telephone number and resume of each such Field Supervisor shall be submitted to the Port of Houston Authority in writing prior to commencement of on-Site work. No Field Supervisor shall be changed during the Contract Time without prior written agreement of the Port Construction Representative. Contractor shall request such agreement by providing written notice of its desire to make such change, which notice shall set forth the reason therefor and the name and qualifications of a proposed replacement. The Contractor’s Field Supervisor(s) shall be authorized to receive notices given by the Port of Houston Authority, Port Construction Representative (or its representative), Design Consultant or the Inspector. Notice given to any such Field Supervisor shall constitute notice to the Contractor.

The Port of Houston Authority shall have the right to require the Contractor to replace any Field Supervisor, if in the discretion of the Port Construction Representative the Field Supervisor is unsatisfactory. Contractor acknowledges and agrees that exercise of such right of the Port of Houston Authority to require the Contractor to replace a Field Supervisor shall not be the basis for any Claim, that Contractor will not assert or pursue and shall not have the right to assert or pursue any Claim based on the exercise of such right, and that exercise of such right shall not entitle Contractor to any relief or recovery, whether for additional compensation, additional time, damages or otherwise.

4.28 **Contractor’s Field Office:**

The Contractor shall provide a temporary field office building at the Site, at a location accepted by the Port Construction Representative, which building shall be the Contractor’s own jobsite headquarters, unless stated otherwise in the Special Conditions. Such building shall be weatherproof and equipped with adequate door and window locks for security of its contents. Such building shall also be equipped with adequate electrical power and illumination, heating facilities, telephone service and telefax service. Contractor shall maintain such building in a clean, sanitary and orderly condition throughout the Contract Time and shall immediately remove such building from the Site upon completion of the Work.
4.29 **Field Office for Port of Houston Authority Personnel:**

Unless stated otherwise in the Special Conditions, the Contractor shall not be required to furnish a field office for the exclusive use of Port of Houston Authority personnel. However, Port of Houston Authority personnel shall have the right to use the Contractor’s buildings and facilities at the Site as needed at no additional cost to the Port of Houston Authority.

4.30 **Contractor’s Local Office:**

The Contractor shall have an office or agent in the greater Houston area during the period of construction. The mailing address, telephone number and telefax number of this office must be on file with the Port Contract Representative prior to the start of any Work.

END OF GENERAL CONDITIONS SECTION 4
SECTION 5.  **SUBCONTRACTORS**

5.01 **Subcontractors and Material Suppliers:**

(a) The Contractor shall not utilize any Subcontractor or Supplier other than those disclosed on the Subcontract Sheet submitted to the Port of Houston Authority as part of Contractor's Bid/Proposal without prior written agreement by the Port of Houston Authority.

The Contractor shall not utilize any Subcontractor or Supplier of any tier to whom the Port of Houston Authority has objection. In the event the Port of Houston Authority objects to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Port of Houston Authority has no objection. If after issuance by the Port Authority of the Purchase Order, the Port of Houston Authority objects to a person or entity proposed in the Contractor’s Subcontract sheet submitted to the Port of Houston Authority as part of Constructor’s Bid/Proposal and the Port of Houston Authority did not voice such objection prior to issuance of the Purchase Order, and if the proposed but rejected Subcontractor or Supplier was reasonably capable of performing the Work pursuant to the Contract Documents and the replacement Subcontractor will not perform the Work pursuant to the Contract Documents for the same or less dollar amount or will cause delay in the Work, the Contractor may assert a Claim for an adjustment of the Contract Price or Contract Time in accordance with Section 8. Assertion of a Claim for an adjustment of the Contract Price or Contract Time pursuant to Section 8 shall be Contractor’s sole and exclusive remedy for any increase in cost or time or damages associated with required replacement of a previously accepted Subcontractor. Any Claim for any other relief Contractor believes it is entitled to as a result of an objection by the Port of Houston Authority to a Subcontractor or Supplier shall also be asserted in accordance with Section 8.

(b) The Contractor shall be responsible to the Port of Houston Authority for acts and omissions of the Contractor’s employees, Subcontractors and Suppliers, and their agents and employees, and other persons performing portions of the Work.

(c) By an appropriate written agreement, the Contractor shall require each Subcontractor and Supplier, to the extent of the Work to be performed by such Subcontractor or Supplier, to be bound to the Contractor by the terms and conditions of the Contract Documents, and to assume toward the Contractor all of the liabilities, obligations and responsibilities that the Contractor, by the Contract Documents, assumes toward the Port of Houston Authority. Each subcontract agreement shall preserve and protect the rights of the Port of Houston Authority under the Contract Documents with respect to the Work to be performed by Subcontractors or Suppliers so that the subcontracting of such Work will not prejudice such rights. Upon request of the Port of Houston Authority, the Contractor shall provide the Port of Houston Authority with all subcontracts. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed sub-subcontractors. Contractor shall require all Subcontractors to:

(i) carry appropriate insurance as required under the Contract Documents,

(ii) **INDEMNIFY THE PORT OF HOUSTON AUTHORITY INDEMNITEES TO THE SAME EXTENT THAT THE CONTRACTOR IS REQUIRED TO INDEMNIFY THE PORT OF HOUSTON AUTHORITY UNDER THE CONTRACT DOCUMENTS,**

(iii) make the same warranties for the applicable portion of the Work to the Port of Houston Authority as required by the Contractor under the Contract Documents,
assign all Intellectual Property Rights to the Port of Houston Authority to the same extent as required by Contractor under the Contract Documents, and

agree to the dispute resolution procedures as set forth in the Contract Documents.

Any specific requirement in this Contract that the responsibilities or obligations of Contractor also apply to a Subcontractor or a Subcontractor of any tier is added for emphasis and is hereby deemed to include all Subcontractors of the Contractor and apply to any other tier of Subcontractor. The omission of a reference to a Subcontractor or a Subcontractor of any tier in connection with any of Contractor’s responsibilities or obligations shall not be construed to diminish, abrogate or limit any responsibilities or obligations of a Subcontractor or a Subcontractor of any tier under the Contract Documents or the applicable subcontract.

5.02 Port of Houston Authority as Third Party Beneficiary of Subcontracts:

Each subcontract entered into between Contractor and a Subcontractor or Supplier shall provide that the Port of Houston Authority is and shall be a third party beneficiary thereof. Notwithstanding any failure of Contractor to comply with the foregoing sentence, the Port of Houston Authority shall be and hereby is deemed to be a third party beneficiary of each such subcontract.

5.03 Port of Houston Authority and Surety as Assignees of Subcontracts:

(a) Each subcontract entered into between Contractor and a Subcontractor shall provide that, in the event of a termination of this Contract, such subcontract shall be assignable to the Port of Houston Authority and/or the Contractor’s surety without the need for any further action on the part of any party hereto or thereto. Notwithstanding any failure of Contractor to comply with the foregoing sentence, the Port of Houston Authority and the Contractor’s surety shall be and hereby are deemed to be permitted assignees with respect to any such subcontract. Upon assignment to the Port of Houston Authority under this Section 5.03(a), the Port of Houston Authority may further assign the subcontract to a successor contractor or other entity for completion of the Project.

(b) Contractor shall assign to Port of Houston Authority, from time to time as Port of Houston Authority may request, all guaranties, warranties, and indemnities extended by any Subcontractor or Supplier with respect to any Work, Equipment and Materials, or services performed or furnished by the issuing party and forming a part of the Work.

5.04 No Benefit of Subcontractor in Contract:

No Subcontractor shall have any beneficial interest in or be a third party beneficiary to any Port of Houston Authority contract (including without limitation this Contract).

5.05 Protection against Claims of Subcontractors, Laborers, and Suppliers:

Pursuant to Section 11.08, THE CONTRACTOR SHALL INDEMNIFY AND SAVE HARMLESS THE PORT OF HOUSTON AUTHORITY INDEMNITEES FROM ALL CLAIMS ARISING OUT OF RELATED TO OR CONNECTED WITH THE DEMANDS OF SUBCONTRACTORS, SUPPLIERS, LABORERS, WORKMEN, MECHANICS, MATERIALMEN AND FURNISHERS OF MACHINERY AND PARTS THEREOF, EQUIPMENT AND MATERIALS, POWER TOOLS AND ALL SUPPLIES INCURRED IN THE PERFORMANCE OF THE CONTRACT. WHEN REQUESTED BY THE PORT OF HOUSTON AUTHORITY, THE CONTRACTOR SHALL FURNISH EVIDENCE SATISFACTORY TO THE PORT OF HOUSTON AUTHORITY THAT ANY OR ALL OBLIGATIONS OWING TO ANY OF THE FOREGOING HAVE BEEN PAID, DISCHARGED OR WAIVED.
END OF GENERAL CONDITIONS SECTION 5
SECTION 6.  CONTRACT TIME AND COMPLETION

6.01  Commencement of Work:

Work shall be commenced by the Contractor only after a fully executed written Purchase Order has been issued by the Port of Houston Authority, only after the effective date of the insurance and bonds required by the Contract Documents, and only after receipt of a written notice to proceed ("Notice to Proceed") from the Port Construction Representative setting forth the Start Work Date. In the event the Contractor begins performance of the Work prior to issuance of such a Purchase Order and Notice to Proceed, the Contractor proceeds at its own risk and shall bear all responsibility therefor and all costs attributable thereto, including without limitation all costs associated with design professionals and other consultants, and be liable for all damages caused thereby. The Contractor acknowledges that the Port of Houston Authority has no liability to or obligation to pay the Contractor for any Work performed in connection with the Project prior to the issuance of such a Purchase Order and Notice to Proceed.

6.02  Start Date for Field Work:

(a) Prior to commencement of any field operations, a preconstruction meeting will be held at a location and time to be determined by the Port of Houston Authority. Contractor and all major Subcontractors shall attend the meeting. The meeting agenda may include and Contractor shall be prepared to discuss: (1) review of Contract Documents; (2) designation of Contractor’s Field Supervisor and other management personnel and Port Authority’s Construction Manager; (3) review of insurance; (4) discussion of formats proposed by the Contractor for Schedule of Costs, Schedule of Submittals, Baseline Schedule and Progress Schedules; (5) procedures and processing of shop drawings and other Submittals, substitutions, pay estimates or applications for payment, Requests for Information, Request for Proposal, Change Orders, and Contract closeout; (6) scheduling of the Work and coordination with other contractors; (7) review of Subcontractors through tier three (3); (8) use of premises by the Port of Houston Authority and Contractor; (9) safety and first aid procedures; (10) construction controls provided by the Port of Houston Authority (if applicable); (11) temporary utilities; (12) survey and layout; (13) security and housekeeping procedures; (14) field office requirements; (15) procedures for testing; and (16) procedures for maintaining record documents.

(b) In most instances, the start date for field work will not be set out in the Bid/Proposal Request. In such a situation, after award of the Contract by the Commission and before the Purchase Order being issued, the parties shall agree on the start date for field work. If the parties cannot agree to such a date, the Port Contract Representative will determine the start date for field work. The Port Contract Representative’s decision shall be final and binding on the Contractor.

In instances in which the Bid/Proposal Request provide the start date for field work, that date shall be the start date for the field work.

(c) In no event, however, shall field work begin prior to receipt and delivery to the Port of Houston Authority of all permits required for start of construction, submission of all Submittals required prior to start of construction including Contractor’s Site health and safety plan and Contractor’s Spill Prevention Plan or Spill Prevention Control and Countermeasure Plan (as applicable), and insurance required by the Contract Documents.

6.03  Working Days:

Unless prior written consent is obtained from the Port Construction Representative as set forth below, the Contractor shall only perform the Work at the Site during Working Days. Contractor is not prohibited from performing work on days that are not Working Days; however, if Contractor wants or intends to work during times other than between 7:00 AM and 6:00 PM on a Working Day, then
Contractor must submit to the Port Construction Representative a proposed schedule setting forth the days and hours during which it intends to work and obtain prior written consent from the Port Construction Representative to such schedule.

6.04 Baseline Schedule:

(a) Baseline Schedule: Within ten (10) Working Days after the Contractor has been notified of the award of Contract and before any field work begins, the Contractor shall furnish for review and acceptance by the Port Construction Representative five (5) copies of its proposed baseline schedule covering prosecution of the Work. The proposed baseline schedule shall be prepared on a Working Day basis unless the Port Construction Representative requests that it be prepared on a calendar day basis, in which case it shall be prepared on a calendar day basis. The proposed baseline schedule shall be prepared on the basis that the Project owns the float.

The Contractor shall provide the proposed baseline schedule in bar graph form as well as critical path form. The proposed baseline schedule shall be dated and, once accepted by the Port Construction Representative, designated as the baseline schedule ("Baseline Schedule"). In addition to a hard copy, the Contractor shall provide an electronic copy of the Baseline Schedule (and any Revised Baseline Schedules and Progress Schedules as such revisions and reports of progress are made from time to time) to the Port of Houston Authority in a software accepted by and in such manner requested by the Port of Houston Authority, including all resource loading and logic diagrams.

The Baseline Schedule shall state the sequence of operations and shall show start/finish dates for all critical and non-critical path construction activities, construction logic, activity sequence, and activity durations. The Baseline Schedule shall include all activities necessary for effective planning, procurement, construction, construction management and timely completion of the Work within the Contract Time and any applicable Milestones, including, but not limited to: start of construction, completion, permit dates, procurement dates, estimated dates that fabrication of items of Equipment and Materials or other Work will commence and be completed, dates for delivery thereof to the Site, Submittal dates, dates required for reviews and acceptances by the Port of Houston Authority for the Contractor to maintain the Baseline Schedule (which dates shall provide for a sufficient time for such review), and the dates for the Port of Houston Authority to supply Port of Houston Authority furnished Equipment and Materials, if any. Furthermore, the Baseline Schedule shall designate sources of supply of all Equipment and Materials and points of manufacture and fabrication of Equipment and Materials or other work to be manufactured or fabricated off Site.

Once accepted, no changes to the Baseline Schedule may be made without acceptance of such change by the Port Construction Representative. In the event Contractor believes a change in the Baseline Schedule is appropriate and such change would not impact the Contract Time, the Contractor shall submit to the Port Construction Representative a signed writing which sets forth the proposed changes and the reason for such changes and warrants that such changes or deviations are necessary. In the event the Contractor believes it is entitled to an extension of Time, the Contractor shall comply with the provisions of Section 8.11.

(b) Revised Baseline Schedules: Contractor shall issue revisions to the Baseline Schedules (and any subsequent Revised Baseline Schedule) to the Port of Houston Authority promptly after Change Orders or Construction Change Directives affecting the Contract Time have been finalized, but in no event later than ten (10) calendar days after the date that the relevant Change Orders or Construction Change Directives are finalized. In addition to a hard copy, the Contractor shall provide the Port of Houston Authority an electronic copy of each Revised Baseline Schedule in a software accepted by and in such manner requested by the Port of Houston Authority, including all resource loading and logic diagrams. Each revision shall be dated and, once accepted by the Port Construction Representative, identified as a "Revised Baseline Schedule" and shall bear the appropriate revision number. Each
Revised Baseline Schedule shall clearly demonstrate all changes in resource loading and/or the planned start and finish dates for all critical and non-critical path numbered Work activities as compared to the most recent Baseline Schedule accepted by the Port Construction Representative. Contractor shall identify and explain any and all logic changes and restraints from the most recent Baseline Schedule (or Revised Baseline Schedule) accepted by the Port Construction Representative. Each Revised Baseline Schedule shall be prepared on the basis that the Project owns the float.

Revised Baseline Schedules are subject to the acceptance of the Port Construction Representative, and, once accepted, no changes may be made thereto without acceptance of the change by the Port Construction Representative. In the event Contractor believes a change in the Revised Progress Schedule is appropriate and such change would not impact the Contract Time, the Contractor shall submit to the Port Construction Representative a signed writing which sets forth the proposed changes and the reason for such changes and warrants that such changes or deviations are necessary. In the event the Contractor believes it is entitled to an extension of Time, the Contractor shall comply with the provisions of Section 8.11.

(c) No extension of the Contract Time and resulting modification to the Baseline Schedule or any Revised Baseline Schedule may occur without a Change Order or Construction Change Directive that modifies the Contract Time.

6.05 Progress Schedules:

(a) The Contractor shall provide the Port of Houston Authority with schedules accurately showing the actual progress of the Work as compared to the Baseline Schedule or latest accepted Revised Baseline Schedule, as appropriate, (each a “Progress Schedule”) (i) at the beginning of each month or more frequent basis as the Port of Houston Authority requests, and (ii) in between such periodic Progress Schedules if non-progress or slow progress is such as to render the previously submitted and accepted Baseline Schedule or Revised Baseline Schedule, as applicable, inaccurate. In addition to a hard copy, the Contractor shall provide the Port of Houston Authority an electronic copy of each Progress Schedule in a software accepted by and in such manner requested by the Port of Houston Authority, including all resource loading and logic diagrams. Such Progress Schedules shall: accurately reflect current conditions; identify and inform the Port of Houston Authority of all deviations in every numbered as-planned activity contained in the latest Baseline Schedule or Revised Baseline Schedule, as applicable, accepted by the Port Construction Representative; and explain the basis for such deviations as well as the Contractor’s plan to bring the schedule back into compliance with the latest Baseline Schedule or Revised Baseline Schedule, as applicable, accepted by the Port Construction Representative.

Each Progress Schedule shall be dated and identify the Baseline Schedule or Revised Baseline Schedule against which progress is shown. Each Progress Schedule shall clearly demonstrate all changes in resource loading and/or the planned start and finish dates for all critical and non-critical path numbered Work activities as compared to the most recent Baseline Schedule or Revised Baseline Schedule, as applicable, accepted by the Port Construction Representative. Contractor shall identify and explain any and all logic changes, original duration changes and restraints from the most recent Baseline Schedule or Revised Baseline Schedule, as applicable, accepted by the Port Construction Representative. Progress Schedules shall be prepared on a “retained logic” basis, as defined by the most recent Primavera Software Operating Manual.

The Progress Schedule shall include, at a minimum, four week look-ahead schedules, an overall construction schedule update, and the an accurate schedule reflecting progress for the entirety of the Work. Subcontractors and Suppliers shall be kept updated on all schedules changes.
Submission of a Progress Schedule shall be a representation by the Contractor that the information reflected in the Progress Schedule is accurate as of the date of submission.

(b) Review, acknowledgement or acceptance of a Progress Schedule shall not constitute acceptance or approval of any revisions to the Baseline Schedule or a Revised Baseline Schedule or a change in the Contract Time. Revisions to the Baseline Schedule and Revised Baseline Schedules shall only occur in compliance with Section 6.04. In the event the Contractor believes it is entitled to an extension of time, it must comply with Section 8.11. No extension of the Contract Time and resulting modification to the Baseline Schedule or any Revised Baseline Schedule may occur without a Change Order or Construction Change Directive that modifies the Contract Time.

6.06 Time of Completion:

(a) TIME IS OF THE ESSENCE OF THE CONTRACT. By executing the Contract, the Contractor confirms that the Contract Time is a reasonable period for performing and completing the Work. The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time and satisfy any Milestones established for the Work.

(b) Contractor shall perform the Work in general accordance with the most recent Baseline Schedule or Revised Baseline Schedule accepted by the Port Construction Representative.

6.07 Lack of Satisfactory Progress:

If the Contractor receives notice from the Port of Houston Authority that the Port of Houston Authority is concerned with the rate of progress of the Work, the Contractor shall, whether or not it disagrees with the Port of Houston Authority’s concern or disputes responsibility for the delay, provide the Port Contract Representative with a written narrative setting forth in a degree of detail acceptable to the Port of Houston Authority a plan of recovery to overcome or mitigate the concern of the Port of Houston Authority or delay, including without limitation, a program describing the additional manpower, overtime, material expediting, re-sequencing of the Work and other steps Contractor shall take to meet the requirements of the Contract with regard to the Contract Time. Moreover, if in the opinion of the Port Contract Representative the rate of progress of the Work is not satisfactory, is not rapid enough to ensure completion within the Contract Time, or the Contractor’s proposed recovery plan is inadequate to achieve such recovery, the Port Contract Representative shall have the right, but not the obligation, to order the Contractor to: (i) employ additional people; (ii) increase its plant; or (iii) prosecute the Work by working longer hours on any portion of the Work which is deemed by the Port Contract Representative to be behind schedule; and in each instance the Contractor shall forthwith comply with any such orders without additional compensation. Alternatively, the Port of Houston Authority may make good any such deficiencies, offset the reasonable cost thereof, including, without limitation, the Port of Houston Authority’s expenses and compensation for any professional services (including without limitation any professional architectural or engineering design services and any attorneys’ fees) made necessary thereby, from any amount due the Contractor or its surety from the Port of Houston Authority. Contractor shall not be entitled to additional compensation (whether as an adjustment in the Contract Price, damages or otherwise) for the schedule recovery efforts. No acceptance, approval or consent by the Port of Houston Authority of any plan for re-sequencing or acceleration of the Work submitted by Contractor pursuant to this Section shall constitute a waiver by the Port of Houston Authority of any liquidated damages or other damages which the Port of Houston Authority may suffer by reason of such re-sequencing or the failure of Contractor to complete the Work by the Contract Time or any applicable Milestone or other requirements of the Contract with regard to the Contract Time.
If the Contractor fails to complete the Work within the Contract Time, the Contractor understands and acknowledges that the Port of Houston Authority may, nonetheless, begin or increase its operations at the Site. Contractor shall, in such instance, perform its remaining Work in such a manner so as not to interfere with such operations, as required in accordance with Section 4.04. Furthermore, Contractor acknowledges and agrees that the impact to Contractor of such operations shall not be the basis for any Claim, Contractor shall not assert or pursue and has no right to assert or pursue any Claim as a result of such operations, and such operations shall not entitle Contractor to any relief or recovery, whether for additional compensation, additional time, damages or otherwise.

6.08 **Liquidated Damages for Delay:**

The Contractor understands and agrees that if the Contractor fails to Substantially Complete its contractual obligation to the Port of Houston Authority within the Contract Time or by the applicable Milestone, the Port of Houston Authority will be damaged. Since damages to the Port of Houston Authority for failure of the Contractor to Substantially Complete the Work within the Contract Time, or applicable portion of the Work by the applicable Milestone, are anticipated at the inception of the Contract, the Contractor shall and hereby does waive any claims that such failure in fact did not damage the Port of Houston Authority and hereby agrees that the Port of Houston Authority's rights to such damages are absolute.

If the Contract Documents provide for payment of liquidated damages, the Contractor understands and agrees that the exact amount of damages to the Port of Houston Authority as a result of failure of the Contractor to Substantially Complete the Work within the Contract Time, or applicable portion of the Work by the applicable Milestone, is and will be difficult to determine. The Port of Houston Authority and the Contractor recognize the delays, expense, and difficulties involved in proving in a legal or mediation proceeding the actual loss suffered by the Port of Houston Authority if the Work is not Substantially Completed within the Contract Time, or applicable portion of the Work by the applicable Milestone. Accordingly, instead of requiring any such proof, the Port of Houston Authority and the Contractor agree that as liquidated damages for delay (but not as a penalty), the Contractor (or its surety) shall pay the Port of Houston Authority, for each CALENDAR day (not Working Day) the Work or applicable portion thereof remains uncompleted past the Contract Time or by the applicable Milestone, as applicable, the sum set out in the Contract Documents as liquidated damages for the Project. The Contractor agrees that each such sum is a fair and reasonable estimate of the amount of damages the Port of Houston Authority will incur if the Work or applicable portion thereof is not completed within the Contract Time or by the applicable Milestone. The number of calendar days comprising the period of time over which liquidated damages accrue shall not be reduced for any reason, including without limitation, by (i) any period of time that Work is not performed by reason of a termination pursuant to Section 9.02, or (ii) in a case where the Contractor’s surety elects to complete the Contract, by the period of time it takes such surety to complete the Contract. The Contractor (and its surety) shall pay the Port of Houston Authority on demand or, at its option, the Port of Houston Authority may withhold from the Contractor or its surety or offset such damages against any amounts due the Contractor or its surety under the Contract or otherwise under Applicable Law. In case full payment for the Work shall have been made, the Port of Houston Authority shall have the right to recover from the Contractor and its surety the amount of such liquidated damages as determined under the Contract.

6.09 **Actual Damages for Delay:**

If the Contract Documents do not provide for any liquidated damages, or the space for designation of liquidated damages is left blank, or an amount of “0” or “none” (however expressed) is inserted in any space for designation of liquidated damages, Contractor acknowledges and agrees that, instead of liquidated damages, the Port of Houston Authority shall be entitled to actual damages for delay in the event the Contractor fails to Substantially Complete the Work by the Contract Time, or the
applicable portion of the Work by any Milestone. Such actual damages are in lieu of and not in addition to liquidated damages. Such actual damages may be withheld from the Contractor or its surety or offset against any monies owed the Contractor or its surety by the Port of Houston Authority or the Port of Houston Authority may collect such damages from the Contractor and the surety on the Contractor’s performance and payment bonds.

6.10 Substantial Completion:

(a) Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Port of Houston Authority can occupy or utilize the entirety of the Work (or designated portion thereof) for its intended use and all required certificates of occupancy and other permits, approvals, licenses, and documents required to occupy the Project by all entities, agencies and Governmental Authorities having jurisdiction over the Project and/or the operation and occupancy of the Project, have been given so that the Project may operate for its intended purpose. The Work will not be considered suitable for Substantial Completion review until all Project systems included in the Work are operational as designed and scheduled, designated instructions of Port of Houston Authority’s personnel in the operation of systems have been completed, and all final finishes within the Contract Documents are in place. In general, the only remaining Work following Substantial Completion shall be minor in nature, so that the Port of Houston Authority can begin full operations on the date of Substantial Completion, and the completion of the Work by the Contractor would not materially interfere with or hamper the Port of Houston Authority’s normal business operation.

As a further condition to achieving Substantial Completion, when the Contractor considers that the Work, or a portion thereof which the Port of Houston Authority agrees to accept separately, is Substantially Complete, the Contractor shall prepare and submit to the Port of Houston Authority a comprehensive list of items to be completed or corrected prior to final payment and shall certify that the list of Items will be completed by the scheduled date for Final Completion. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. The Contractor shall proceed promptly to complete and correct all items on the list. Unless a longer period of time is agreed to in a writing signed and issued by the Port Contract Representative, all items on the list shall be corrected and completed within thirty (30) days of Substantial Completion.

Upon receipt of the Contractor’s list, the Inspector will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Inspector discloses any item, whether or not included on the Contractor’s list, which is not sufficiently complete in accordance with the Contract Documents so that the Port of Houston Authority can occupy or utilize the Work or designated portion thereof for its intended use or prevents the other requirements for Substantial Completion from being met, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Inspector. In such case, the Contractor shall then submit a request for another inspection by the Inspector to determine Substantial Completion.

(b) When the Work or designated portion thereof is substantially complete in the opinion of the Inspector, the Contractor will prepare a Certificate of Substantial Completion in a form acceptable to the Port Contract Representative and for the Port Contract Representative’s acceptance, certifying that the Work is in accordance with Section 6.10(a), which, once accepted by the Port Contract Representative, shall establish the date of Substantial Completion, shall establish responsibilities of the Port of Houston Authority and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate.
The Certificate of Substantial Completion shall be submitted to the Inspector for acceptance, and, if accepted, then to the Port Contract Representative and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance the Contractor shall submit a proposed Estimate for Contract Payment in accordance with the Contract Documents for any unpaid sums associated with such Work or designated portion thereof, less retainage. In addition to retainage, such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents, and any other amounts that the Port of Houston Authority is entitled to withhold pursuant to the Contract Documents.

6.11 Partial Utilization by the Port of Houston Authority:

Acceptance or use by the Port of Houston Authority of any part of the Work which:

(a) has specifically been identified in the Contract Documents as constituting; or

(b) the Port of Houston Authority and the Contractor agree constitutes;

a separately functioning and usable part of the Work which part can be used by the Port of Houston Authority for its intended purpose without significantly interfering with the Contractor’s performance of the remainder of the Work, may occur prior to Substantial Completion. Such acceptance or usage shall not:

(i) constitute acceptance of Work not complying with the requirements of the Contract Documents;

(ii) begin the running of any warranties; or

(iii) be cause for any partial release of retainage;

unless and to the extent the Port Contract Representative agrees otherwise in writing expressly stating acceptance of specified work, the extent to which warranties begin to run, or the extent to which retainage will be released, as applicable.

The Contractor shall coordinate with the Port Authority the completion and clean-up of such portions of Work so as to meet the Port Authority’s needs. Additionally, the Contractor shall coordinate with the Port Authority access to such portions of the Work for correction of nonconforming Work to minimize disruption of the Port of Houston Authority’s activities where the Port of Houston Authority is in partial utilization.

6.12 Final Completion:

(a) On Final Completion of the Contract, all portions of the Work must be carefully reviewed and inspected by the Contractor. The Contractor shall satisfy itself that every item of the Work is Finally Completed and all defects have been made good, and that all surplus materials, refuse, dirt and rubbish have been cleaned up and removed from the Site or properly disposed of, and that the entire Work is in a finished, satisfactory and neat condition, and ready in all respects for final acceptance by the Port of Houston Authority.

Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final proposed Estimate for Contract Payment and other documentation required by the Contract Documents for final payment, the Inspector will make such inspection. When the Inspector finds the Work acceptable under the Contract Documents and the Contract fully and properly performed (including without limitation completion of all punch list items and satisfaction of all other requirements for final payment, including without limitation delivery of all required documentation and, if the Port of
Houston Authority chooses to conduct an audit, completion of an audit by the Port of Houston Authority’s auditors), the Contractor will issue a final proposed Estimate for Contract Payment for acceptance by the Port Contract Representative certifying that the Work has been completed in accordance with the terms and conditions of the Contract Documents, including all requirements for Substantial Completion under Section 6.10 and all requirements for final payment, and that the entire balance found to be due the Contractor and noted in the final proposed Estimate for Contract Payment is due and payable. For Projects with a Contract Price based on unit costs, the Port of Houston Authority shall determine the actual final quantities of the Work and give to the Contractor a copy of such final quantities at which time the Contractor shall revise its Schedule of Costs accordingly and resubmit such revised Schedule of Costs to the Port of Houston Authority with the Contractor’s final proposed Estimate for Contract Payment. The Contractor’s final proposed Estimate for Contract Payment will constitute a further representation that conditions listed in Section 6.12(b) as conditions precedent to the Contractor’s being entitled to final payment have been fulfilled.

(b) Neither final payment nor any remaining retained percentage shall become due and the Project shall not be finally complete until the Contractor submits to the Port Construction Representative and the Port Contract Representative accepts:

(i) final releases from each person (including all Subcontractors and Suppliers who performed work at or for, or provided or fabricated materials in connection with, the Work (including all subcontracts executed in connection therewith), other than from those persons whose claims are being contested by Contractor in good faith and for which Contractor has provided the Port of Houston Authority a bond or security in an amount acceptable to the Port of Houston Authority; provided, however, that IF A SUBCONTRACTOR, SUPPLIER OR OTHER PERSON OR ENTITY REFUSES TO FURNISH A RELEASE REQUIRED BY THE PORT OF HOUSTON AUTHORITY, THE CONTRACTOR MAY FURNISH A BOND SATISFACTORY TO THE PORT OF HOUSTON AUTHORITY AGAINST SUCH CLAIM. IF SUCH CLAIM REMAINS UNSATISFIED AFTER PAYMENTS ARE MADE, THE CONTRACTOR SHALL INDEMNIFY THE PORT OF HOUSTON AUTHORITY INDEMNITEES FOR ALL LOSS AND COST, INCLUDING REASONABLE ATTORNEYS’ FEES INCURRED AS A RESULT OF SUCH CLAIM;

(ii) an affidavit that payrolls, bills for Equipment and Materials, and other indebtedness connected with the Work for which the Port of Houston Authority might be responsible (less amounts withheld by the Port of Houston Authority) have been paid or otherwise satisfied;

(iii) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days’ prior written notice has been given to the Port of Houston Authority;

(iv) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents;

(v) consent of surety to final payment;

(vi) if required by the Port of Houston Authority, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Port of Houston Authority;
(vii) a final, unconditional certificate of occupancy and all construction-related approvals, licenses, documents and requirements for the Project enabling it to be occupied and operated for its intended use;

(viii) certification that all of the requirements for Substantial Completion under Section 6.10 have been met and all Work, including all punch list items, has been fully and finally completed;

(ix) complete list of Subcontractors and principal Suppliers, including addresses, telephone numbers, and name of individuals to contact who are familiar with the Project (including the Contractor);

(x) six (6) copies of all operations and maintenance manuals, records, instructions and data;

(xi) six (6) copies of all written guarantees and warranties in the form prescribed by the Contract Documents;

(xii) as-built drawing and other documentation required by Section 4.12;

(xiii) Work Product in accordance with Section 2.05;

(xiv) Project record documents;

(xv) keys, access cards, and any other items for access to and security of the premises, as well as spare parts, overages, and maintenance materials;

(xvi) closeout Submittals as identified; and

(xvii) all other documentation required by the Contract Documents.

6.13 **No Delay Damages:**

Except to the extent expressly set forth in Section 6.15 for events of Force Majeure, the Contractor shall receive no financial compensation for delay, interference, disruption, or hindrance at any time in the commencement or progress of the Work for any reason and for any period of time: by any act, omission or neglect, intentional or otherwise, of the Port of Houston Authority, Design Consultant or any other consultant of the Port of Houston Authority, or of an employee of any of them, or of a separate contractor employed by the Port of Houston Authority; or by Changes ordered in the Work; or by fire, unavoidable casualties or other causes beyond the Contractor’s control; or by delay authorized by the Port of Houston Authority pending mediation; or by other causes that the Port Contract Representative determines may justify delay. To the fullest extent allowed by Applicable Law, except to the extent set forth in Section 6.15 for events of Force Majeure, in no event shall the Port of Houston Authority be liable to the Contractor or any Subcontractor or Supplier, any other person or any surety for or any employee or agent of any of them, for any damages arising out of or associated with any delay, interference, disruption, or hindrance to the Work, regardless of the source of the delay, interference, disruption, or hindrance. THE FOREGOING PORTIONS OF THIS PARAGRAPH SHALL APPLY EVEN IF SUCH DELAY, HINDRANCE, DISRUPTION OR INTERFERENCE RESULTS FROM, ARISES OUT OF OR IS DUE, IN WHOLE OR IN PART, TO THE NEGLIGENCE OR OTHER TORTIOUS CONDUCT, BAD FAITH, ARBITRARY OR CAPRICIOUS CONDUCT, INEQUITABLE CONDUCT, BREACH OF CONTRACT OR OTHER FAULT, HOWEVER CHARACTERIZED, OR STRICT LIABILITY WITHOUT REGARD TO FAULT, OF THE PORT OF HOUSTON AUTHORITY OR THE EMPLOYEES OR AGENTS OF THE PORT OF HOUSTON AUTHORITY. Except to the extent expressly set forth in Section 6.15 for
events of Force Majeure, the Contractor's sole remedy in any such case shall be an extension of time. Claims for extensions of time shall be made in accordance with Section 8.11.

6.14 Right of Port of Houston Authority to Accelerate Work and Reschedule Work:

(a) In the event the Port of Houston Authority desires to accelerate the Work from the latest accepted Baseline Schedule or Revised Baseline Schedule, as applicable, for reasons other than delays caused by or attributable to the Contractor, changed conditions, Changes, or other events addressed separately by the Contract Documents, the Port Contract Representative shall so notify the Contractor by request for Change Proposal. Contractor shall respond to such request for Change Proposal in accordance with Section 8.04, including providing the Port Contract Representative with Contractor's plan to achieve such acceleration and all cost impacts, if any, from such acceleration. Before proceeding with any such Port of Houston Authority-directed acceleration plan under this Section, the Contractor shall have received the Port of Houston Authority's prior written acceptance of the Contractor's plan to implement the acceleration in the form of a Construction Change Directive or, in the event such plan includes an increase in cost, a Change Order. Upon receipt of such Construction Change Directive or Change Order, Contractor shall require its personnel and its Subcontractors and Suppliers to work such overtime hours and/or to increase their respective work forces as may be reasonably necessary to meet the Port of Houston Authority's acceleration goals.

(b) In the event the Port of Houston Authority desires to reschedule portions of the Work from the latest accepted Baseline Schedule or Revised Baseline Schedule, as applicable, for reasons other than delays or events caused by or attributable to the Contractor, changed conditions, Changes, or other events addressed separately by the Contract Documents, the Port Contract Representative shall so notify the Contractor by Construction Change Directive. Contractor shall respond to such Construction Change Directive in accordance with Section 8.03.

6.15 Events of Force Majeure:

(a) Event of Force Majeure. Subject to Section 6.15(c), an event of "Force Majeure" shall mean any circumstance described in Section 6.15(b), but only if and to the extent that:

(i) such circumstance cannot reasonably be, or reasonably be caused to be, prevented, avoided or removed by the impacted Party;

(ii) such event materially adversely affects the ability of such Party to perform its obligations under this Contract;

(iii) such event is not the result of any failure of such Party to perform any of its obligations under this Contract or is otherwise caused by the Party claiming force majeure or its Subcontractors or Suppliers of any tier; and

(iv) such Party has given the other Party notice within five (5) Working Days from the occurrence thereof, describing such event, the expected duration thereof, the effect thereof and the actions being taken in order to comply with this Section 6.15.

(b) Events of Force Majeure. Subject to Sections 6.15(a) and 6.15(c), events of Force Majeure shall mean:

(i) acts of war or the public enemy;

(ii) epidemic, civil disturbances, insurrection, rebellion, sabotage, terrorism, riots or violent demonstrations;
(iii) earthquakes, hurricanes, tornadoes, and floods;
(iv) fire or explosion;
(v) evacuations of the Site ordered by Governmental Authority; and
(vi) judicial restraint.

Events not specifically listed herein shall not constitute events of Force Majeure, including, but not limited to, material or equipment shortages, market fluctuations and labor shortages, slow downs, strikes or other material, equipment or labor disturbances. Furthermore, weather which is not abnormal, even if such weather could not be reasonably anticipated and even if such weather prevents the performance of the Work, shall not be an event of Force Majeure.

(c) Certain Delays not Excused. Notwithstanding that an event of Force Majeure otherwise exists, the following provisions of this Section 6.15(c) shall not excuse and shall not be considered an event of Force Majeure:

(i) Subcontractor or Supplier non-performance or late performance;
(ii) non-payment of taxes by Contractor or any Subcontractor or Supplier;
(iii) customs procedures;
(iv) delay of Contractor in obtaining, or failure to obtain or maintain, approval of any Government Authority;
(v) non-compliance with Applicable Law by Contractor or its Subcontractors or Suppliers;
(vi) late delivery of Equipment and Materials by Contractor, its Subcontractors or Suppliers;
(vii) mechanical or electrical breakdown or failure of Equipment and Materials, machinery or plant owned or operated by Contractor or any Subcontractor or Supplier; or
(viii) failure of Contractor to perform any of its obligations under this Contract in accordance with the requirements hereof prior to the occurrence of an event of Force Majeure.

(d) Effect of Force Majeure. Neither Party shall be considered to be in default or in breach of its obligations under this Contract if and to the extent that its failure of, or delay in, performance is due to an event of Force Majeure; provided, that:

(i) no obligations of the affected Party which arose before the occurrence causing the suspension of performance that remain unaffected by the Force Majeure are excused as a result of the occurrence;
(ii) the affected Party uses reasonable efforts to overcome or mitigate the effects of such occurrence; and
(iii) when the affected Party is able to resume performance of its obligations under this Contract, such Party shall give the other Party written notice to that effect and shall promptly resume performance hereunder.
The additional delay and, subject to Section 6.15(g), costs incurred by or damages to Contractor as a result of any event of Force Majeure shall be subject to the procedures set forth in Section 8 regarding extensions of time and additional costs. Failure to comply with the requirements of Section 8 shall be deemed a waiver of any Claim for an extension of time, additional costs, damages or other relief due to an event of Force Majeure.

(e) Mitigation. The Parties shall:

(i) make all reasonable efforts to prevent and reduce to a minimum and mitigate the effect of any delay occasioned by any event of Force Majeure by among other things, recourse to alternate acceptable sources of services, Equipment and Materials; and

(ii) use their best efforts to ensure resumption of normal performance of this Contract to the maximum extent practicable after the termination of any event of Force Majeure and shall perform their obligations hereunder to the extent practicable and agreed between the Parties.

(f) Port of Houston Authority Self-Help. If within a reasonable time after an event of Force Majeure has occurred that has caused Contractor to suspend or delay performance of the Work, reasonable action that Contractor could initiate to remove or relieve either the Force Majeure or its direct or indirect effects has been identified and recommended to Contractor by Port of Houston Authority, and Contractor has failed to take such action, then the Port of Houston Authority may, in its sole discretion and after notice to Contractor, at Contractor’s expense, initiate such reasonable measures as will be designed to remove or relieve such Force Majeure or its direct or indirect effects, and thereafter require Contractor to resume full or partial performance of the Work in accordance with the provisions of this Contract. The costs of any such action taken by the Port of Houston Authority shall be reimbursed by Contractor (or its surety) to the Port of Houston Authority and the Port of Houston Authority may offset any such costs in whole or in part against any amount due or thereafter becoming due to Contractor or its surety.

(g) Increased Costs and Damages for Events of Force Majeure. Contractor shall assert any Claim for damages and increased costs arising out of an event of Force Majeure in accordance with Section 8.06. Such damages and increased costs due to delay shall be limited to the actual increase in cost to the Contractor solely as a result of delay arising out of an event of Force Majeure of (i) any Site office for the Contractor, and (ii) maintaining Contractor’s salaried personnel at the Site or on the Project, in each instance, for the period of such delay. Contractor shall not be entitled to any damages or increased costs to the extent encompassed by any insurance maintained by Contractor or maintained by others in connection with the Project or the Work.

END OF GENERAL CONDITIONS SECTION 6
SECTION 7. CORRECTION OF WORK

7.01 Substandard Material, Equipment, or Workmanship:

All Work shall be subject to the acceptance of the Port Contract Representative who shall have the right to condemn any part thereof that is not strictly in compliance with the Contract Documents. The Port Contract Representative shall have the right to order the removal of any Equipment and Materials which in its judgment is not fit to be used in the Work. Immediately upon the rejection by the Port Contract Representative of any Equipment and Materials or Work, the Contractor shall remove such condemned Equipment and Materials or Work from the Site, and shall proceed to dismantle the Work rejected, and, solely at its own expense, replace such Work with Equipment and Materials and workmanship of the quality and character required by the Contract Documents. If however, any defective Equipment and Materials or workmanship is incorporated into construction, which defect in itself is not of such a nature as to require removal or reconstruction, the Port Contract Representative shall have the right, in its sole discretion, to elect to accept such Equipment and Materials or workmanship and to determine the reduction in value as is commensurate with the reduction in quality or in workmanship. Pursuant to Section 10.15, the Port of Houston Authority shall have the right to offset the amount of such reduction against amounts owing to the Contractor or its surety or to recover such amount from either of them.

7.02 Port of Houston Authority’s Right to Carry Out the Work:

If, during the course of the Work, the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven (7) day period after receipt of written notice from the Port of Houston Authority to commence and continue correction of such default or neglect with diligence and promptness, the Port of Houston Authority may, without prejudice to other remedies the Port of Houston Authority may have, correct such deficiencies; provided, however, that the Port of Houston Authority shall be entitled to take remedial and other necessary action in any emergency without waiting until the expiration of such seven (7) day period. In either case, the Port of Houston Authority may offset from payments then or thereafter due the Contractor (or its surety) the cost of correcting such deficiencies, including the Port of Houston Authority’s expenses and compensation for any Design Consultant’s additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor (or its surety) are not sufficient to cover such amounts, the Contractor (or its surety) shall pay the difference to the Port of Houston Authority.

7.03 Port of Houston Authority’s Right to Stop the Work:

If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Sections 7.01 or 7.02 or fails to carry out Work in accordance with the Contract Documents, the Port of Houston Authority may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Port of Houston Authority to stop the Work shall not give rise to a duty on the part of the Port of Houston Authority to exercise this right for the benefit of the Contractor or any other person or entity.

7.04 Discovery and Correction of Latent Defective Work:

(a) Correction During Performance of the Work:

Defective or nonconforming Work, including any portion of the Work which does not satisfy Section 7.05, shall be rebuilt or properly repaired or replaced at the Contractor’s sole cost whenever discovered, such that it satisfies the Contract Documents, including Section 7.05.
(b) **Obligation to Repair After Substantial Completion:**

Notwithstanding any provision in the Contract Documents to the contrary, for a minimum of one year after Substantial Completion the Contractor shall, upon receiving notice from the Port of Houston Authority, be obligated to replace or correct, without cost to the Port of Houston Authority, any Work which is improperly performed, defective, in breach of the warranties set forth in Section 7.05(a) or otherwise not in full compliance with the Contract Documents such that after such re-performance such Work or portion thereof satisfies the Standard of Care, warranties and Contract Documents.

This Section 7.04(b) shall not be construed to limit any other obligations of Contractor pursuant to this Contract, which obligations by their terms are intended to be binding for periods of time longer than those of the periods set forth in this Section 7.04(b). For the avoidance of doubt the period set forth in this Section relates only to the specific obligation of the Contractor to replace or correct the Work and has no relationship to the time period during which the Contractor shall be obligated to comply with or be liable for breach of its other obligations, warranties and covenants set forth in the Contract Documents. The Contractor agrees that the Port of Houston Authority may seek to enforce this Contract or establish Contractor's liability with respect thereto for as long as permitted Applicable Law or such longer time period set forth in this Contract.

(c) **Watertight Repairs:**

In addition to Contractor’s obligations set forth above and elsewhere in the Contract Documents, Contractor shall repair, at no cost to Port of Houston Authority, for a period of twelve (12) months after Substantial Completion, any building(s) that is not watertight and leak proof at every point and in every area, except where leaks can be attributed to damage to the building(s) by abnormal external forces beyond Contractor's control or due to design errors of the Port of Houston Authority. Contractor shall, immediately upon notification by Port of Houston Authority of water penetration, determine the source of water penetration and, at its own expense, do any work necessary to make the building(s) watertight. Contractor shall also, at its own expense, repair or replace any other damaged material, finishes, and furnishings, damaged as a result of this water penetration, to return the building(s) to its (their) original condition.

(d) **Responsibility for Cost and Port of Houston Authority Right to Correct:**

When performing repair, replacement or correction pursuant to this Section 7.04, Contractor shall also make good all damage to other work caused by such repair, replacement or correction. The Contractor shall bear and be responsible for all costs of every nature incurred by the Contractor or the Port of Houston Authority in connection with such discovery, repair, replacement or correction, including without limitation costs associated with design professionals and other consultants, and shall be liable for all damages caused by the defective or nonconforming Work. If the Contractor fails to repair, replace or correct such Work, or is incapable of performing such repairs, replacements or corrections, or is incapable of performing such repairs, replacements or corrections in time to meet any requirements of the Port of Houston Authority, the Port of Houston Authority may, but is not obligated to, replace, repair or correct the Work itself or with a third party, and the Contractor or its surety shall reimburse the Port of Houston Authority for the expense of such repair, replacement or correction, including without limitation all costs associated with design professionals and other consultants, along with any other damages to the Port of Houston Authority resulting from such improper Work, or the Port of Houston Authority may offset such expenses and damages from any amount due the Contractor or its surety.
7.05 **Warranties:**

(a) **General Warranty:**

The Contractor covenants, represents and warrants that it will perform the Work in accordance with its Standard of Care. The Contractor covenants, represents and warrants to the Port of Houston Authority that all items of the Work: (a) are merchantable, safe, and fit for their intended purpose; (b) are new and of good quality, and free from all defects in workmanship and materials; and (c) conform to all accepted Submittals and all requirements and provisions of the Contract Documents. Work not conforming to these requirements, including substitutions not properly accepted and authorized, shall be considered defective. If required by the Port Contract Representative, the Contractor shall furnish satisfactory evidence as to the kind and quality of Equipment and Materials. Contractor's express warranties contained herein are not limited by the provisions of Section 7.02, 7.03 or 7.04 and shall be in addition to any other warranties and obligations of Contractor, and any other claims, rights, actions or remedies that the Port of Houston Authority may have, in the Contract Documents, at law or in equity.

(b) **Subcontractor Warranties:**

In addition to the warranties required pursuant to Section 7.05(a), Contractor shall obtain from its applicable Subcontractors and Suppliers any warranties and guarantees which are specified by the Contract Documents to extend for more than one (1) year following Substantial Completion. Contractor shall assign such extended warranties and guarantees directly to the Port of Houston Authority upon Final Completion.

Contractor shall obtain from all other Subcontractors and Suppliers warranties with coverage at least as broad as that required of Contractor under the Contract Documents for a period of one (1) year following Substantial Completion. During such one (1) year warranty period, Contractor shall enforce the Subcontractors’ and Suppliers’ warranties for the benefit of the Port of Houston Authority or its assigns. After expiration of such one (1) year period, the Contractor shall continue to aid the Port of Houston Authority in enforcing any continuing warranties assigned to the Port of Houston Authority, but such assistance shall be at the Port of Houston Authority’s expense.

If extended warranties in addition to those required by the Contract Documents are available from Subcontractors or Suppliers, Contractor shall advise the Port of Houston Authority of such availability and the cost thereof and, if requested by Change Order, shall purchase the extended warranty for the Port of Houston Authority Authority’s benefit, in which event the Change Order shall reflect an increase in the Contract Price equal to the cost of the extended warranty submitted to and accepted by the Port of Houston Authority.

The Contractor shall supply the Port of Houston Authority with original copies of all warranties made to the Contractor by Suppliers or Subcontractors. All guarantees and warranties of Equipment and Materials and services furnished to Contractor or Subcontractors by any Subcontractor or Supplier shall be assignable to and shall be deemed to run for the benefit of the Port of Houston Authority. Contractor hereby assigns to the Port of Houston Authority the benefits of all guarantees and warranties of all Subcontractors and Suppliers engaged for the Project, but such assignment shall not relieve Contractor of its warranty obligations to the Port of Houston Authority under the Contract Documents or Applicable Laws. If the Contractor is prevented for any reason from making any such assignment, the Contractor hereby consents to the Port of Houston Authority’s enforcing any and all such nonassignable warranties in the Contractor’s name and the Contractor agrees that the Port of Houston Authority shall be entitled to any benefits derived therefrom without the need for any further action on the part of either the Contractor or the Port of Houston Authority. The Contractor further agrees to perform the Work in such a manner so as to preserve any and all such guarantees and warranties.
(c) **Miscellaneous:**

Additional warranties for specific items may also be required by the Specifications. The Contractor shall submit such warranties to the Port of Houston Authority for its acceptance before final payment will be made to the Contractor. Such warranties shall be assigned to the Port of Houston Authority.

Contractor shall not intentionally waive or take any action to prejudice or void any warranties as to Equipment and Materials or component parts used in the Work or as to any Subcontractor’s work without The Port Contract Representative’s prior written consent.

**END OF GENERAL CONDITIONS SECTION 7**
SECTION 8.  CHANGES, CLAIMS AND DISPUTES

8.01 Authority to Change and Resolve Claims:

The only person in the Port of Houston Authority Engineering Department with authority to resolve engineering/technical questions, problems or Claims, agree to Changes, and to resolve engineering/technical disputes involving the Contract or Bid/Proposal where the Port of Houston Authority is specifically given such authority in this Contract, is the Port Contract Representative. No other employee of the Port of Houston Authority Engineering Department has such authority. Any such resolutions must be in writing and signed by the Port Contract Representative. Any Claim by the Contractor that any terms or conditions of the Contract Documents have been Changed or waived must be evidenced by an agreement in writing accepted and signed by the Port Contract Representative.

Neither the Inspectors nor any Design Consultant or other consultant of the Port of Houston Authority have any authority to Change, expressly or impliedly, any of the terms and conditions of the Contract or to resolve questions, problems, Claims, or disputes involving the Contract or Bid/Proposal.

Notwithstanding the foregoing, the Contractor is hereby advised that approval by the Commission is required for certain matters.

8.02 Changes:

(a) The Port Contract Representative reserves the right to make such Changes within the general scope of the Work as the Port Contract Representative may deem necessary or appropriate and without notice to the surety.

(b) The Contractor shall not proceed with Changes without a written Construction Change Directive or fully executed Change Order from the Port Contract Representative. Such Construction Change Directives or Change Orders shall stipulate the Change and any Change in the Work to be performed as a result of such Change, any difference in time allowance and, with respect to Change Orders, any difference in Contract Price, whether such price is increased or decreased pursuant thereto. The Contractor shall under no circumstances have the right to Change the Work to be performed under this Contract, nor shall any Claim for additional compensation (whether asserted as an adjustment to the Contract Price, damages, or otherwise), extension of time or other relief in connection with any assertion of extra or additional work by the Contractor be allowed or entertained, unless such Change shall have been ordered as part of a Change Order or Construction Change Directive. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of change, modification, adjustment, revision, addition to, deletion from or alteration to the Work, and no Claim that the Port of Houston Authority has been unjustly enriched by any modification, adjustment, revision, addition to, deletion from or alteration to the Work, whether or not there is, in fact, any unjust enrichment to the Port of Houston Authority, shall be the basis of any Claim to any increase in any amounts due (whether asserted as an adjustment to the Contract Price, damages, or otherwise) in any time period provided for in the Contract Documents. Changes in the Work may be made without notice to Contractor’s sureties and absence of such notice shall not relieve such sureties of any of their obligations to Port of Houston Authority.

(c) The Contractor shall not be entitled to additional compensation (whether in the form of an adjustment to the Contract Price, damages, or otherwise) unless the cost of the Work is directly and materially impacted by the Change in the Work. Methods used in determining the amount of additional compensation (whether in the form of an adjustment to the Contract Price, damages, or otherwise) may include those listed in Section 8.07. The Contractor shall not be entitled to relief from the requirement to complete the Work within the Contract Time or to an increase in the Contract Time unless the additional time is established pursuant to Section 8.11.
(d) Agreement on any Construction Change Directive and on any Change Order shall constitute a final settlement of all matters relating to and relief to the Contractor as a result of the Change which is the subject of the Construction Change Directive or Change Order, including but not limited to, all direct and indirect costs associated with such Change and any right of the Contractor to any additional compensation as a result of such Change (whether in the form of an adjustment to the Contract Price, damages, or otherwise) and any and all adjustments to the Contract Time and the latest accepted Baseline Schedule or Revised Baseline Schedule, as applicable. Accordingly, Contractor hereby waives any Claim it may have to additional compensation and adjustments in the Contract Time arising out of the cumulative effect of any and all Changes, whether characterized by Contractor as adjustments, damages or other relief and regardless of the legal or equitable theory on which they are based. In the event a Change Order increases the Contract Price, Contractor shall include the Work covered by such Change Orders in its proposed Estimates for Contract Payment as if such Work were originally part of the Contract Documents.

8.03 Construction Change Directive:

Upon receipt of a Construction Change Directive, the Contractor shall, within the time limits set forth in Section 8.05, notify the Port Construction Representative in writing, with a copy to the Port Contract Representative, if it believes the Construction Change Directive merits an extension of the Contract Time different from what was provided for in the Construction Change Directive, if any, or an adjustment in the Contract Price, or otherwise entitles the Contractor to some form of relief. In such an event, Contractor shall comply with the procedures set forth in Sections 8.05 through 8.11 governing Contractor’s Claims. If the Contractor does not make its objection in writing to the Port Construction Representative, with a copy to the Port Contract Representative, within such period, it shall be conclusively presumed that:

(i) the Change described in the Construction Change Directive does not call for any Work that will result in an increase in the Contract Price, additional compensation, damages or other relief; and

(ii) the Contractor agrees with any adjustment to the Contract Time and any Change to provisions of the Contract Documents set forth in the Construction Change Directive; and

the Contractor shall perform the Work in accordance with the Construction Change Directive and shall not be entitled to any adjustment in the Contract Time or other Contract provisions other than set forth in the Construction Change Directive or to additional compensation, an adjustment in the Contract Price, damages or other relief. In such an event, the Contractor will be deemed to have waived its right to any increase in the Contract Time (other than that set forth in the Construction Change Directive) or to additional compensation, an adjustment in Contract Price, damages or other relief arising out of the Construction Change Directive.

A Construction Change Directive signed by the Contractor indicates the agreement of the Contractor therewith, including adjustment to the Contract Time and lack of a right to compensation, adjustment to the Contract Price, damages or other relief. Such agreement shall be effective immediately and shall be recorded as a Change Order.

8.04 Proposal Request:

The Port Construction Representative may request that the Contractor provide a proposal for a Change (“Change Proposal”). Within five (5) days following receipt of a request, Contractor shall submit a Change Proposal to Port Construction Representative together with the revised or new documents which, if accepted, will become part of the Contract Documents setting forth any requested adjustment in the
Contract Price or the Contract Time or other Contract provision, and including an itemization of all costs of material and labor with extensions listing quantities and total cost, and a substantiation of any Claim for an extension of the Contract Time or Contract Price in accordance with Section 8. Such Change Proposal shall be submitted in writing on Contractor’s letterhead and manually signed by Contractor. If no Change Proposal is submitted by Contractor within such period, it shall be conclusively presumed that the Change described in the request does not call for any Work that will result in an increase in cost or time, otherwise modify the provisions of the Contract Documents, or entitle the Contractor to damages or other relief and such Change shall be performed by Contractor without any such increase, modification, right to recovery of costs or damages or other relief, the Contractor having waived any right it might have to an increase, modification, damages or other relief. If Contractor is unable to submit the above information within the time limit, it shall notify the Port Construction Representative in writing, setting forth for the Port Construction Representative’s acceptance a date by which Contractor will submit the information as well as a schedule for the performance of the Work for which a Change Proposal will be forthcoming.

If the Port Construction Representative accepts a Change Proposal submitted by Contractor, the Port Construction Representative will recommend that the Port Contract Representative issue a Construction Change Directive or, if the Change Proposal includes an adjustment to the Contract Price or other provision of the Contract Documents, that the Port Contract Representative recommend to the Commission an adjustment in the Contract Price and modification of other Contract provisions through a Change Order.

Nothing contained herein shall limit the right of the Port Contract Representative to order Changes in Work by Construction Change Directives and Contractor shall promptly perform all Work required under the Contract Documents or a Construction Change Directive despite its refusal to accept or execute a Change Order.

8.05 Contractor’s Claims:

(a) Contractor acknowledges and agrees that performance of the Work and completion of the Project require regular communication between the Contractor and the Port of Houston Authority and that such communications occur in a variety of forms. Contractor further acknowledges and agrees that (i) communications from the Port of Houston Authority will occur through Inspectors, consultants, the Port Contract Representative and other Port of Houston Authority personnel, (ii) there are limitations on the authority of all such individuals, (iii) it is possible that such an individual and the Contractor may view events differently, have conflicting positions on an issue, or disagree on interpretation of the Contract Documents, and (iv) the fact of a communication by any such individual evidencing a view, position, or interpretation different from or conflicting with that of the Contractor is not a breach of Contract or an act that, in and of itself, subjects the Port of Houston Authority to liability or entitles Contractor to any relief or recovery. Rather, Contractor agrees that it will communicate any such difference in view, position or interpretation and any belief of a right to relief (whether in the form of modification or adjustment to the Contract provisions, damages, or otherwise) as a result of such communications and any other Claims pursuant to the procedures set forth in this Section 8. Contractor acknowledges and agrees that the Port of Houston Authority is relying on Contractor to raise with the Port of Houston Authority any Claims that the Contractor has or believes it has in accordance with this Section 8 so that the fact of the Claim, investigation and understanding of the underlying communications, occurrences and events giving rise to the Claim, and resolution of the Claim (including, if appropriate, reversal or modification of a prior communication, issuance of a Construction Change Directive, or agreement upon a Change Order), can occur at a point in time that will eliminate or reduce any additional costs, increase in time for performance, damages to and liabilities of the parties.
b) Contractor’s Claims must be initiated by written notice to the Port Construction Representative with a copy to the Port Contract Representative. The responsibility to substantiate Claims shall rest with the Contractor.

Claims by the Contractor must be initiated within five (5) days after occurrence of the communication or other event giving rise to such Claim or within five (5) days after the Contractor first recognizes the condition giving rise to the Claim, whichever is later, or such shorter time, if any, for a particular type of Claim as is set forth in the Contract Documents. Any Claim not timely initiated by Contractor shall be deemed waived by Contractor and Contractor shall not be entitled to any relief based upon such Claim, whether in the form of an adjustment to a Contract provision, damages, or otherwise.

Pending final resolution of a Claim except as otherwise agreed in writing or in the event of termination pursuant to Section 9, the Contractor shall proceed diligently with performance of the Contract, and the Port of Houston Authority shall continue to make payments in accordance with the Contract Documents to the extent such payments are not in dispute or the Port of Houston Authority is not entitled to withhold payment.

c) Contractor shall develop and implement a system and procedures for preparing, reviewing and processing Changes and Claims which fully complies with Section 8 and assures that the preparation of Change Proposals and responses to Construction Change Directives pursuant to Section 8.03 and requests for Change Proposals pursuant to Section 8.04 shall always include the simultaneous submittal of: (a) a comprehensive narrative explaining the reasons for any requested Changes; (b) the identification of all supporting documents being used to verify any requested cost, time or other Contract Document changes; and (c) a detailed narrative evaluation of critical path schedule impacts, if any.

d) Contractor shall develop and implement a system and procedures for: (i) evaluating all Change Proposals and Claims submitted by Subcontractors and Suppliers of every tier for compliance with the requirements of the Contract Documents; (ii) recommending resolutions and options to the Port of Houston Authority in writing with respect to such Change Proposals and Claims; and (iii) implementing written Construction Change Directives and Change Orders accepted by the Port of Houston Authority in writing.

8.06 Claims for Additional Compensation:

a) If the Contractor believes additional cost of the Work is involved or that the Contractor is entitled to additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise) in connection with the Work for reasons including but not limited to (i) a written response, instruction or interpretation from the Port of Houston Authority, Design Consultant or other consultant, if any, (ii) an order by the Port of Houston Authority to stop the Work where the Contractor was not at fault, (iii) a written order for a minor Change in the Work issued by the Port of Houston Authority, Design Consultant or other consultant, if any, (iv) issuance of a Construction Change Directive, (v) termination of the Contract by the Port of Houston Authority, (vi) event of Force Majeure, or (vii) any other communications, events, occurrence or grounds, a Claim shall be filed in accordance with Section 8.05. Contractor shall not be entitled to additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise) in circumstances where another provision of the Contract Documents precludes it.

b) If the Contractor wishes to make a Claim for additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise), written notice as provided in Section 8.05 shall be given no later than the time specified in Section 8.05 and IN NO EVENT SHALL CONTRACTOR BEGIN PERFORMING THAT PORTION OF THE WORK AFFECTED BY SUCH COMMUNICATION OR OTHER EVENT PRIOR TO GIVING SUCH WRITTEN NOTICE TO THE PORT CONTRACT REPRESENTATIVE. Such notice shall include at a minimum:
(i) a written cause and effect narrative which identifies: (y) the communications, event(s) or occurrence(s) forming the basis for Contractor’s Claim; and (z) the specific contractual provisions being relied upon by the Contractor to establish the Port of Houston Authority’s responsibility for each proposed, pending or disputed right to additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise), including the contractual provisions which establish whether the claimed communication, event or occurrence entitles the Contractor to additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise); and

(ii) the amount sought by the Contractor, properly itemized and supported by the data required to recover costs under Section 8.07(c) and such other sufficient substantiating data as the Port Contract Representative may require to permit evaluation.

Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 3.12, but shall be provided on the first Working Day following the communication, event or occurrence.

8.07 Calculations of Additional Compensation for Claims, Changes or Modifications:

(a) If the Contractor is entitled to additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise) due to:

(i) Changes ordered pursuant to Sections 8.02, 8.03 or 8.04;

(ii) changed conditions or Contract interpretations or other communications pursuant to Sections 8.09 and 8.10;

(iii) suspension of Work ordered pursuant to Section 9.03;

(iv) acceleration of Work ordered pursuant to Section 6.14; or

(v) any other communication, event or occurrence that entitles Contractor to additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise) pursuant to the Contract Documents;

such additional compensation shall be determined in accordance with and limited to those costs set forth in this Section 8.07.

(b) If the Contractor is entitled to additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise), the adjustment shall be based on one of the following methods:

(i) mutual acceptance of a fixed price properly itemized and supported by sufficient substantiating data satisfactory to the Port Contract Representative to permit evaluation;

(ii) unit costs stated in the Contract Documents or subsequently agreed upon by the parties;

(iii) cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

(iv) as provided in Section 8.07(c).
(c) If the Contractor and Port Construction Representative do not agree upon the method for or amount of additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise), the amount shall be determined by the Port Construction Representative on the basis of reasonable expenditures and savings of those performing the Work attributable to the Change, communication, occurrence or event forming the basis for the Claim, including, in case of a Change in the Work implemented by a Construction Change Directive or Change Order, a reasonable allowance for overhead and profit determined in accordance with Section 8.07(d). The Contractor shall not, however, be entitled to an increase in overhead or profit for increases in cost associated with any other communication, event or occurrence, including changed conditions. If the Contractor and Port Construction Representative do not agree upon the method for or amount of additional compensation (whether in the form of an adjustment to the Contract Price, damages or otherwise), and also under Section 8.07(b)(iv), the Contractor shall keep and present, in such form as the Port Contract Representative may prescribe, an itemized accounting together with supporting data satisfactory to the Port Contract Representative. Contractor shall maintain daily records of the Work attributable to the Change, communication, occurrence or event forming the basis for the Claim and shall provide copies of these records daily, signed by the Contractor's Field Supervisor, along with actual invoices and other cost substantiating records to the Construction Manager at the end of each month. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 8.07(c) shall be limited to the following substantiated costs for the Work attributable to the Change, communication, occurrence or event forming the basis for the Claim:

(i) costs of labor of those approved by the Port Construction Representative actually engaged in such Work, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

(ii) costs of Materials, including cost of transportation, whether incorporated or consumed in such Work, based on actual delivered invoice costs, less any discount;

(iii) actual rental costs of Equipment as substantiated by invoices, exclusive of hand tools, whether rented from the Contractor or others, for each hour that the Equipment is involved in such Work; provided, however, for a particular piece of Equipment owned by the Contractor, the rental cost will be based upon a reasonable hourly rate, as agreed upon in writing by the Port Contract Representative before such Work is begun;

(1) Payment will not be made for time lost for Equipment breakdowns, time spent to repair Equipment, or time after Equipment is no longer needed; provided, however, if Equipment is used intermittently while dedicated solely to such Work, payment will be made for the duration the Equipment is assigned to such Work but no more than 8 hours per day;

(iv) actual costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to such Work; and

(v) actual additional costs of supervision and field office personnel directly attributable to such Work;

provided, however, that all such costs shall be reasonable and in no event shall such costs exceed the prevailing rates in the vicinity of the Project.

The Port Contract Representative may set prior limitations on the type and kind of Equipment and Materials for which the Contractor will be compensated.
The Contractor’s fee for overhead and profit, when allowed as a cost, shall be determined as follows:

(i) a mutually acceptable fixed fee; or

(ii) if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

(a) for costs incurred under Sections 8.07(c)(i) and (c)(ii) for labor in the direct employee of Contractor and Equipment and Materials supplied directly by Contractor, the Contractor’s fee shall be fifteen percent (15%);

(b) for costs incurred under Sections 8.07(c)(i) and (c)(ii) for labor, Equipment and Materials provided by Subcontractors, the Contractor’s fee shall be five percent (5%);

(c) where one or more tiers of subcontractors are on the basis of cost of the work plus a fee and no fixed fee is agreed upon, the intent of Section 8.07(d)(ii)(a) is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee not to exceed ten percent (10%) of the costs incurred by such Subcontractor under Sections 8.07(c)(i) and (c)(ii) and that any higher tier Subcontractor and Contractor will each be paid a fee not to exceed five percent (5%) of the amount paid to the next lower tier Subcontractor;

(d) no fee shall be payable on the basis of costs itemized under Sections 8.07(c)(iii), 8.07(c)(iv) and 8.07(c)(v);

(e) for any Change which results in a net decrease in cost will be the amount of the actual net decrease in cost, a deduction in Contractor’s fee by an amount equal to five percent of such net decrease; and

(f) when both additions and credits are involved in any one Change, the adjustment in Contractor’s fee shall be computed on the basis of the net change in accordance with Sections 8.07(d)(ii)(a) through 8.07(d)(ii)(e), inclusive.

Notwithstanding anything in the Contract Documents which may indicate otherwise, the maximum amount payable by the Port of Houston Authority for all overhead, profit and commissions relating to any Claims arising out of this Contract, shall not exceed a maximum aggregate amount equivalent to fifteen percent (15%) of the total of the items listed in Sections 8.07(c)(i) – (ii), regardless of the number of tiers of Subcontractors or Suppliers involved in performing the Change or impacted by the occurrence or event, and regardless of whether the Contractor self-performs a portion of the Change in the Work with its own personnel.

(e) The amount of credit to be allowed by the Contractor to the Port of Houston Authority for a deletion or Change which results in a net decrease in the Contract Price shall be actual net cost as determined by the Port Construction Representative.

(f) In the event the Contractor disagrees with the determination made by the Port Construction Representative pursuant to this Section 8.07, the Contractor may, within five (5) calendar days of the Port Construction Representative’s determination, seek review of the decision by the Port Contract Representative pursuant to Section 8.13 by a signed, written notice to the Port Contract Representative, with a copy to the Port Construction Representative. Failure of the Contractor to seek
review of the Port Construction Representative’s decision within such five (5) calendar days period shall be deemed agreement with the Port Construction Representative’s determination and a waiver by the Contractor of its right to assert and recover on a Claim for additional compensation in addition to the adjustment, if any, set forth in the Port Construction Representative’s determination.

8.08 Limitations on the Costs of Changes or Modifications:

The original Contract Price may not be increased by more than twenty-five percent (25%) or decreased by more than eighteen percent (18%) without the consent of the Contractor. The execution of a Change Order by the Contractor for amounts in excess of such limitations shall constitute consent.

8.09 Claims for Changed Conditions:

Subject to the Contractor’s representations and warranties set forth in Section 2.06, if conditions are encountered at the Site that amount to:

(i) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or otherwise discoverable by the Contractor from the Contract Documents or a review of the Site and surrounding area; or

(ii) unknown physical conditions of an unusual nature, which conditions differ materially from those originally found to exist at the Site and from those normally expected to be inherent in construction activities of the character provided for in the Contract Documents;

then the Contractor shall give written notice to the Construction Manager, with a copy to the Port Construction Representative, promptly before such conditions are disturbed and in no event later than five (5) calendar days after first observing such conditions. If the Contractor believes it is entitled to additional compensation (whether as an adjustment to the Contract Price, damages or otherwise), additional time (whether as an adjustment to the Contract Time, relief from its obligation to perform within the Contract Time, or otherwise) or both as a result of such conditions, it shall state the basis for the entitlement and the amount of the addition in such Claim notice. No additional compensation or time or other adjustment shall be permitted, however, in connection with a concealed or unknown condition which is of a usual nature or does not differ materially from those conditions:

(a) ordinarily encountered and generally recognized as inherent to work of the nature provided for in this Contract;

(b) reasonably inferable from the Contract Documents, or which were disclosed by, which could have been investigated, or which reasonably should have been discovered by the Contractor’s:

   (1) prior inspections, tests, and reviews, for the Project; or

   (2) inspections, tests, and reviews, which the Contractor had the opportunity to make or should have performed based on the Standard of Care; or

(c) which the Contractor should reasonably have known or anticipated based on the area in which the Site is located, the type of improvements involved, and the practices prevalent in the construction industry.

Any such Claim not timely made by the Contractor shall be deemed waived by the Contractor. After the Construction Manager receives such notice, the Port Construction Representative will investigate such conditions and, if the Port Construction Representative agrees that such conditions entitle the Contractor to
an adjustment in time, compensation or both, the Port Construction Representative will so inform the Port Contract Representative and recommend, as appropriate, that the Port Contract Representative issue an appropriate adjustment (whether an increase or a decrease) to the Contract Time or that the Port Contract Representative recommend to the Commission that an appropriate adjustment (whether an increase or decrease) be made to the Contract Price or other Contract Documents provisions. If the Port Construction Representative determines that the conditions at the Site are not materially different from those indicated in the Contract Documents and/or that no Change to the terms of the Contract is justified, the Port Construction Representative shall so notify the Contractor. In the event the Contractor disagrees with the determination made by the Port Construction Representative, the Contractor may, within five (5) calendar days of the Port Construction Representative’s determination, seek review of the decision by the Port Contract Representative pursuant to Section 8.13 by a signed, written notice to the Port Contract Representative, with a copy to the Port Construction Representative. Failure of the Contractor to seek review of the Port Construction Representative’s decision within such five (5) calendar days period shall be deemed agreement with the Port Construction Representative’s determination and a waiver by the Contractor of its right to assert and recover on a Claim in respect of such condition in addition to the adjustment, if any, set forth in the Port Construction Representative’s determination.

8.10 Claims for Contract Interpretations and other Communications:

If the Contractor believes that any response to an RFI, interpretation of the Contract Documents, response to a Submittal, or other communication by the Port Construction Representative, Inspectors, Port Contract Representative or other employee of the Port of Houston Authority or by a Design Consultant or any other consultant of the Port of Houston Authority constitutes a Change, is inconsistent with the Contract Documents, or would entitle Contractor to assert or recover on a Claim of any nature, the Contractor shall immediately notify the Port Construction Representative, with a copy to the Port Contract Representative, in writing, and in any event such notice shall be given within five (5) calendar days after such response, interpretation or communication. If the Contractor believes it is entitled to additional compensation, time, or both whether as an adjustment in the Contract Time, Contract Price or both or in the form of damages or other relief, as a result of such response, interpretation or communication, it shall state the basis for the entitlement and the amount of the entitlement in such notice and comply with the provisions of Sections 8.05, 8.06, 8.07 and 8.11, as applicable. IN NO EVENT SHALL CONTRACTOR BEGIN PERFORMING THAT PORTION OF THE WORK AFFECTED BY SUCH RESPONSE, INTERPRETATION OR COMMUNICATION PRIOR TO GIVING SUCH WRITTEN NOTICE TO THE PORT CONSTRUCTION REPRESENTATIVE, WITH A COPY TO THE PORT CONTRACT REPRESENTATIVE. Any notice not timely made by the Contractor shall be deemed a waiver by the Contractor of its right to assert and recover on a Claim in respect of such response, interpretation or communication. The Port Construction Representative will promptly conduct an investigation pursuant to such notice and, if the Port Construction Representative agrees that such response, interpretation or communication is a Change, is inconsistent with the Contract Documents, or would entitle Contractor to assert or recover on a Claim of any nature, the Port Construction Representative will determine whether to proceed with such response, interpretation or communication and, if so, recommend to the Port Contract Representative that the Port Contract Representative issue a Construction Change Directive or recommend to the Commission an equitable adjustment to the Contract Price or other Contract provisions, as applicable; provided, however, that in the event the communication forming the basis of Contractor’s notice is a communication from the Port Construction Representative, the Port Construction Representative shall conduct such investigation and make such determination. If the Port Construction Representative or Port Contract Representative, as applicable, determines that such response, interpretation or communication is not a Change or otherwise is not inconsistent with the Contract Documents, the Port Construction Representative or Port Contract Representative, as applicable, shall so notify the Contractor. In the event the investigation and determination is made by the Port Construction Representative and the Contractor disagrees with such determination, the Contractor may, within five (5) calendar days of the Port Construction Representative’s determination, seek review of the decision by the Port Contract Representative pursuant to Section 8.13 by a signed, written notice to the Port Contract Representative, with a copy to the Port Construction Representative.
Representative. Failure of the Contractor to seek review of the Port Construction Representative’s decision within such five (5) calendar days period shall be deemed agreement with the Port Construction Representative’s determination and a waiver by the Contractor of its right to assert and recover on a Claim in respect of such response, interpretation or communication in addition to the adjustment, if any, set forth in the Port Construction Representative’s determination.

8.11 Claims for Time Extensions:

(a) Subject to Sections 8.11(b), (c), (d) and (e), if the Contractor is delayed or hindered at any time in the commencement or progress of the Work, or the commencement or progress of the Work is otherwise interfered with or disrupted by:

(i) an action or inaction of the Port of Houston Authority, or of an employee of the Port of Houston Authority, or of a separate contractor or consultant employed by the Port of Houston Authority; or

(ii) by Changes ordered in the Work; or

(iii) by a weather event or an event of Force Majeure; or

(iv) by delay authorized by the Port of Houston Authority pending mediation; or

(v) by other causes which the Port Contract Representative determines may justify delay;

then, if the other requirements for an extension of time set forth in Section 8.11 are met, the Port Construction Representative will recommend to the Port Contract Representative that the Contract Time shall be extended by Construction Change Directive or Change Order, as applicable, for such time as the Port Construction Representative may determine that the Contractor was prevented from performing Work on the critical path, keeping in mind that the Project owns the float. The Contractor may seek review by the Port Contract Representative of the Port Construction Representative’s recommendation pursuant to Section 8.13 by a signed, written notice to the Port Contract Representative, with a copy to the Port Construction Representative. Acceptance or rejection of requests for time extensions shall be made in the sole discretion of the Port Contract Representative. Any extension of time shall not release the Contractor or its surety from their obligations under the Contract Documents, all of which shall remain in full force until completely discharged.

(b) Subject to Sections 8.11(c) and (d), if the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided in this Section 8.11 shall be given on the first Working Day of the week following the week in which the communication, event or occurrence forming the basis for the Claim for an increase in Contract Time first occurs. Such request must contain, at a minimum, the following information:

(i) the latest Revised Baseline Schedule where a Change in the Contract Time was previously made by formal Change Order and/or Construction Change Directive, along with any Change Orders and Construction Change Directives upon which Contractor is relying;

(ii) the latest Progress Schedule which must reflect actual as-built start/finish dates of all relevant activities and be without any constraints, logic changes, hiatuses or other interruptions or deviations;
(iii) graphic analyses comparing the Contractor's Baseline Schedule (or latest Revised Baseline Schedule, if applicable) versus the latest Progress Schedule showing actual as-built conditions, either by computer-generated graphics or by similar presentations, which comparison must identify all relevant critical path changes;

(iv) written cause and effect narratives which identify each critical path activity by: (a) activity number; (b) the specific calendar dates when the critical path delay occurred; (c) the cause of such delay; and (d) the specific contractual provisions being relied upon by the Contractor to establish the Port of Houston Authority’s responsibility for each proposed, pending or disputed Change in the Contract Time, including the contractual provisions which establish whether the claimed delay entitles the Contractor to an extension of time;

(v) written explanation which clearly depicts and explains all instances of Concurrent Delay;

(vi) written explanation of any constraints, logic changes, critical path changes, hiatuses, interruptions or similar deviations, including all underlying assumptions relating to any such changes made by the Contractor in compiling the delay analyses required by the Contract Documents; and

(vii) written statement describing in a degree of detail acceptable to the Port Contract Representative all steps taken and being taken by Contractor to mitigate against the cause of the relevant adverse schedule impact.

In the case of a continuing delay, only one Claim is necessary.

(c) Subject to Sections 8.11(b) and 8.11(d), if adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were greater in the aggregate than the number of days set forth in the Special Conditions as allocated for weather days for each month during the performance of the Work. Contractor expressly acknowledges and agrees that it has accepted the risk associated with any weather events or weather conditions that delay performance of the Work for a cumulative total period of the number of days set forth in the Special Conditions as allocated for weather days or less, in the aggregate, for each month or that the Contractor may make up on weekends or through schedule or staffing adjustments. To the extent that there are weather events or weather conditions that delay performance that are in excess in the aggregate of the number of days for each month set forth in the Special Conditions as allocated for weather days, there shall be a day for day extension of the Contract Time, but only if Contractor complies with the provisions of this Section 8.11, and, in any event, Contractor shall not be entitled to any additional money, an adjustment in the Contract Price or damages as a result of any delay caused by adverse weather conditions or adverse weather events other than to the extent set forth in Section 6.15 for events of Force Majeure.

(d) No extensions of time in certain events:

Notwithstanding the provisions of Sections 8.11(a), (b) and (c) or any other provision of the Contract Documents that might entitle the Contractor to an extension of time, no extensions of time will be granted for any of the following events or occurrences:

(i) when the principal units of Work and tasks on the critical path are not in progress or are not delayed by the event of delay, interference, disruption, or hindrance;

(ii) when at least seven (7) hours of available working time remain out of the Working Day or calendar day, as applicable;
(iii) while materials are drying and it is possible for the Contractor to enclose the area and use drying devices;

(iv) when an event of delay, interference, disruption, or hindrance occurs on a day other than a Working Day or other day when the Contractor had not originally planned to work;

(v) when an event of delay, interference, disruption, or hindrance occurs after the expiration of the Contract Time;

(vi) when adverse weather is the basis of the delay, interference, disruption or hindrance, when an extension is precluded pursuant to Section 8.11(c);

(vii) to the extent the Contractor could have anticipated or alleviated the impact of the event of delay, interference, disruption, or hindrance through reasonable efforts;

(viii) when events of Concurrent Delay overlap the claimed delay; and

(ix) when an extension of time is precluded by any other provision of the Contract Documents.

(e) Failure to file requests for time extensions within the time set forth in and otherwise as required by this Section 8.11 shall constitute a waiver of any rights the Contractor may have had to such time extensions.

8.12 Injury or Damage to Person or Property:

If Contractor suffers injury or damage to person or property because of an act or omission of the Port of Houston Authority, or of others for whose acts the Port of Houston Authority is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the Port of Houston Authority in accordance with Section 3.12. The notice shall provide sufficient detail to enable the Port of Houston Authority to investigate the matter.

8.13 Dispute Resolution, Submission to Jurisdiction, Waiver of Right to Remove and Venue:

(a) Submission to Port Contract Representative: Claims, including those alleging an error or omission by the Port of Houston Authority and or any Design Consultant or other consultant of the Port of Houston Authority, shall be referred to the Port Contract Representative. The Port Contract Representative will review Claims and within thirty (30) days of the receipt of the Claim take one or more of the following actions: (1) request from the Contractor additional supporting data or responses to questions of the Port Contract Representative, (2) reject the Claim in whole or in part, (3) accept the Claim, or (4) suggest a compromise.

If the Port Contract Representative requests the Contractor to furnish additional supporting data or respond to questions, the Contractor shall, within ten (10) days after receipt of such request, either provide a response or the requested supporting data, advise the Port Contract Representative when the response or supporting data will be furnished, or advise the Port Contract Representative that no supporting data will be furnished. Based on such response and any supporting data, the Port Contract Representative will make a decision with respect to the Claim; provided, however, that if the Contractor does not provide a response or the requested supported data within such (10) day period and the Port Contract Representative does not agree to a longer period of time, the Port Contract Representative may make a decision on the Claim without such response or supporting data.
In the event Contractor disagrees with the decision of the Port Contract Representative regarding any Claim or in any other event in which there is a dispute connected to, arising out of or relating to the implementation of or performance of this Contract which the Port of Houston Authority and Contractor have been unable to resolve within thirty (30) days after such dispute arises, a senior representative of the Contractor shall meet with the Port Contract Representative at a mutually agreed upon time and place not later than forty-five (45) days after such decision of the Port Contract Representative or such dispute arises, as applicable, to attempt to resolve the Claim or dispute.

(b) Mediation: In the event the Port Contract Representative and senior representative of the Contractor are unable to resolve any such dispute within fifteen (15) days after the meeting required pursuant to Section 8.13(a), either party may, by written notice to the other, submit such dispute to non-binding mediation before a mutually agreeable mediator. If the parties are unable to agree upon a mediator within twenty (20) days after such written notice of submission to mediation, the American Arbitration Association shall be empowered to appoint a qualified mediator, which mediator, unless otherwise agreed by the parties, shall be a lawyer with no less than fifteen (15) years of experience. The mediation shall be conducted within thirty (30) days of the selection or appointment of the mediator, as applicable. The parties shall share the mediator’s fee and any filing fees equally. The mediation shall be held at a mutually agreeable location in Houston, Texas. If the parties are unable to agree upon a location, the mediation shall be held at the offices of the American Arbitration Association in Houston, Texas. Participation in non-binding mediation in accordance with this paragraph shall be a condition precedent to Contractor having the right to file any legal or equitable action against the Port of Houston Authority or any of its commissioners, officers, directors, employees or agents.

(c) Jurisdiction and Venue: Subject to the Contractor’s obligation to comply with the requirements of the foregoing Sections 8.13 (a) and (b) as a condition precedent to the Contractor having any right to file any legal or equitable action against the Port of Houston Authority or any of its commissioners, officers, directors, employees or agents, for purposes of all legal or equitable proceedings arising out of, relating to or connected with this Contract, the Work, or the Project, the Contractor hereby agrees that this Contract is performable in whole or in part in Houston, Harris County, Texas, and hereby submits to the jurisdiction of the state courts within Houston, Harris County, Texas, and agrees that such jurisdiction shall be exclusive with respect to any such proceeding filed by Contractor. For the avoidance of doubt, the Contractor hereby expressly, clearly and unequivocally agrees that the Port of Houston Authority has the right to choose the forum in which any legal or equitable proceeding arising out of, relating to or connected with this Contract, the Work, or the Project shall be heard; and, having so agreed, the Contractor hereby irrevocably waives its right to remove any such proceeding to any federal court should the Port of Houston Authority choose to bring any proceeding in any state court of Texas. Furthermore, to the fullest extent permitted by law, Contractor hereby irrevocably waives any objection which it may now or hereafter have to the laying of venue of any proceeding arising out of, relating to or connected with this Contract, the Work, or the Project in any state court residing in Houston, Harris County, Texas. Finally, Contractor hereby irrevocably waives any claim which it may now or hereafter have that any such proceeding brought in any state court in Houston, Harris County, Texas, has been brought in an inconvenient forum.

(d) Right to Notify Surety: The Port of Houston Authority may, but is not obligated to, notify the surety of the nature and amount of any claim against the Contractor. If the claim relates to a possibility of a Contractor’s default, the Port of Houston Authority may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy.

(e) Recovery of Attorneys’ Fees: If Contractor brings one or more Claims against the Port Authority, then for each such Claim, the prevailing party shall be entitled to recover the reasonable expenses and attorneys’ fees incurred by such prevailing party as a result of each such Claim from the other party, to the maximum extent allowed by Applicable Law.
8.14 **Compliance with Claim Procedures:**

Contractor hereby confirms its willingness and ability to comply with the requirements of this Section 8 and hereby agrees that the time periods, notice requirements and procedures set forth in this Section 8 are reasonable time periods, notice requirements and procedures and that the Port of Houston Authority will be prejudiced if Contractor fails to comply with such time periods, notice requirements and procedures. ACCORDINGLY, CONTRACTOR’S FAILURE TO COMPLY WITH THE TIME PERIODS, NOTICE REQUIREMENTS AND PROCEDURES OF THIS SECTION 8 WITH RESPECT TO A CLAIM SHALL CONSTITUTE A WAIVER OF THE CLAIM, INCLUDING CLAIMS ARISING OUT OF THE PORT OF HOUSTON AUTHORITY’S NEGLIGENCE OR OTHER TORTIOUS CONDUCT, BAD FAITH, ARBITRARY OR CAPRICIOUS CONDUCT, INEQUITABLE CONDUCT, BREACH OF CONTRACT OR OTHER FAULT, HOWEVER CHARACTERIZED, OR STRICT LIABILITY WITHOUT REGARD TO FAULT.

END OF GENERAL CONDITIONS SECTION 8
SECTION 9. TERMINATION AND SUSPENSION

9.01 Termination for Convenience of the Port of Houston Authority:

The Port of Houston Authority may terminate this Contract, in whole or in part, at any time without cause by written notice to Contractor. Upon receipt of such notice, the Contractor shall immediately:

(i) cease operations as directed by the Port of Houston Authority in the notice;

(ii) take actions necessary, or that the Port of Houston Authority may direct, for the protection and preservation of the Work;

(iii) place no further orders or subcontracts for Equipment and Materials, services, or facilities except as may be necessary or required for completion of such portion of the Work under the Contract that is not terminated;

(iv) assist the Port of Houston Authority as specifically requested, in writing, in the maintenance, protection, and disposition of property acquired by the Port of Houston Authority under the Contract;

(v) transfer to the Port of Houston Authority title to Work completed for which payment is made to the Contractor; and

(vi) except for Work directed to be performed prior to the effective date of termination stated in the notice and for those subcontracts assigned to the Port of Houston Authority at the Port of Houston Authority’s direction, terminate all existing subcontracts and purchase orders on terms satisfactory to the Port of Houston Authority.

Within thirty (30) calendar days after receipt of such notice, the Contractor shall submit a statement showing, in the form normally required for proposed Estimates for Contract Payment or such other form required by and in a degree of detail satisfactory to the Port Contract Representative, the Work properly in place and performed under the Contract prior to the date of termination and setting forth the amount due Contractor pursuant to this paragraph. Such statement shall be processed for payment as any other Estimate for Contract Payment. Contractor shall be entitled to payment of that proportion of the Contract Price which the properly performed in place Work bears to the total Work called for under the Contract, less any payments previously made, less any costs of any nature whatsoever, including without limitation costs associated with design professionals and other consultants, to the Port of Houston Authority associated with any defective or improper Work by the Contractor or other damages to the Port of Houston Authority for which the Contractor is liable, and less any other amounts which the Port of Houston Authority is entitled to withhold. Payment of such amount is the sole right and remedy of the Contractor and the only compensation to which the Contractor is entitled upon termination for convenience by the Port of Houston Authority.

The Contractor shall ensure that all subcontracts contain a similar termination provision. The Contractor is hereby advised and agrees that the Port of Houston Authority will not pay and will not be required to compensate the Contractor for, and Contractor hereby waives any Claims for and right to, any loss of profits, loss of work, termination or additional payment to Subcontractors or Suppliers, or any other damage or out of pocket costs incurred or resulting from such termination, and for any portion of the Work
not in place or not in strict compliance with the Contract Documents or Equipment and Materials (ordered, delivered, on hand, or otherwise) not incorporated into the Work. In the event the amount due the Contractor is less than the amount the Port of Houston Authority is entitled to deduct from such payment, the Contractor or its surety shall pay the Port of Houston Authority the difference.

9.02 **Termination for Cause by the Port of Houston Authority:**

In the event the Contractor:

(i) refuses or fails to supply enough properly skilled workers or proper Equipment and Materials;

(ii) fails to make payment to Subcontractors for Equipment and Materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

(iii) disregards Applicable Laws;

(iv) assigns the Contract or any part thereof in violation of the Contract Documents;

(v) subcontracts Work in violation of the Contract Documents;

(vi) fails to commence the Work in accordance with the provisions of the Contract Documents;

(vii) fails to prosecute the Work in accordance with its Standard of Care and in strict accordance with the Contract Documents;

(viii) breaches any warranty made by the Contractor under or pursuant to the Contract Documents;

(ix) fails to furnish the Port Contract Representative with assurances satisfactory to the Port Contract Representative evidencing the Contractor’s ability to complete the Work in compliance with all the requirements of the Contract Documents;

(x) fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than seven (7) days, except as permitted under the Contract Documents;

(xi) makes a general assignment for the benefit of its creditors, is unable to pay its debts as they become due, or becomes the subject of any voluntary or involuntary bankruptcy, insolvency, arrangement, reorganization or other debtor relief proceeding under any law, state or federal, now in existence or hereafter becoming effective, or any amendment thereto; or

(xii) otherwise fails to perform in accordance with the Contract Documents;

the Port of Houston Authority may, upon one (1) day’s written notice to the Contractor, terminate, in whole or in part, the Contractor’s right to continue with performance of the Contract or the Contract itself and may:
(a) exclude the Contractor from the Site and take possession of the Site and of all Equipment
and Materials, tools, and construction equipment and machinery thereon owned by the
Contractor;

(b) accept assignment of subcontracts; and

(c) finish the Work by whatever reasonable method the Port of Houston Authority may deem
expedient.

The termination of Contractor’s employment pursuant to this Section 9.02 shall not, unless the Port of
Houston Authority expressly agrees in writing, constitute a termination of the Contract, the obligations of
Contractor under the Contract, the obligations of Contractor’s surety under any bond, or the obligations of
any surety under any Subcontractor bond.

Upon receipt of any such written notice of termination pursuant to this Section 9.02, the
Contractor shall, at its expense, for that Work affected by any such termination:

(x) make an inventory of all Equipment and Materials in storage at the Site, in route to the
Site, in storage or manufacture away from the Site, and on order from Suppliers;

(y) assign to the Port of Houston Authority subcontracts, supply contracts, and equipment
rental agreements, all as designated by the Port of Houston Authority; and

(z) remove from the Site all Equipment and Materials listed in said inventory other than such
Equipment and Materials which are designated in writing by the Port of Houston Authority to
remain.

In the event of termination pursuant to this Section 9.02, the Port of Houston Authority shall not
be obligated to complete the Contract. Alternatively, if the Port of Houston Authority exercises such right
of termination, the Port of Houston Authority shall have the right, but not the obligation, to (i) make
demand upon the surety of the Contractor’s performance bond to complete the Contract, or (ii) elect to
complete the Contract itself or have it completed by another contractor. If the Port of Houston Authority
so makes demand upon the surety, the surety shall have the right and privilege, within seven (7) calendar
days after receipt of written notice from the Port of Houston Authority making such demand, to assume
control of the Contract and all Work performed thereunder and thereafter and to sublet or complete the
Work in strict conformity with the Contract. Failure of the surety to do so within such seven (7) calendar
days will result in an immediate forfeiture of all rights under such surety’s bond and otherwise at law, in
which event the Port of Houston Authority shall have the right to take the prosecution of the Work out of
the hands of the Contractor and such surety and to appropriate or use any or all Equipment and Materials
as may be suitable and acceptable, and enter into an agreement for the completion of the Contract
according to its terms and provisions or to use such other methods as in the Port of Houston Authority’s
opinion may be required or desirable for the completion of the Work. Under no circumstances shall the
Port of Houston Authority be obligated to let all or any portion of the incomplete Work for rebid or re-
proposal, but may make such expenditures as in the Port of Houston Authority’s sole judgment will best
accomplish completion.

All costs incurred by the Port of Houston Authority in terminating pursuant to this Section 9.02,
including without limitation any costs associated with design professionals and other consultants, court
costs, attorneys’ fees and experts’ fees, together with the costs of completing the Work, shall be deducted
from any money due or which may become due to the Contractor or its surety. If the Port of Houston
Authority elects to complete the Work and all costs pursuant to the foregoing sentence are less than the
sum which would have been payable under the Contract had it been completed by the Contractor, then
the Contractor or its surety shall be entitled to receive the difference. If such cost exceeds such sum,
then the Contractor and its surety shall be liable to and shall pay the Port of Houston Authority the amount of such excess. If the Port of Houston Authority elects to complete the Contract, regardless of whether the surety or the Port of Houston Authority is responsible for completing the Contract, neither the Contractor nor its surety shall be entitled to any further payment until the Work has been finally completed and finally accepted by the Port of Houston Authority.

The provisions of this Section 9.02 shall not limit any other rights of the Port of Houston Authority or any other remedies available to the Port of Houston Authority at law or equity, nor shall forbearance by the Port of Houston Authority to enforce one or more of the remedies provided herein upon an event of default by Contractor be deemed or construed to constitute a waiver of such default.

9.03 Right of Port of Houston Authority to Suspend the Work:

The Port of Houston Authority may at any time, with or without cause, suspend performance of all or any portion of the Work by giving Contractor written notice specifying which portion of the Work is to be suspended and the effective date of such suspension. Contractor shall continue to diligently perform any remaining Work that is not suspended and shall take all actions necessary to maintain and safeguard all Equipment and Materials and Work in progress affected by the suspension. Upon receipt of such written notice, the Contractor shall, unless the notice required otherwise:

(i) immediately discontinue work on the date and to the extent specified in the notice;

(ii) place no further orders or subcontracts for Equipment and Materials, services, or facilities with respect to suspended Work other than to the extent required in the notice;

(iii) promptly make every reasonable effort to obtain suspension upon terms satisfactory to the Port of Houston Authority of all orders, subcontracts, and rental agreements to the extent that they relate to performance of Work suspended; and

(iv) unless otherwise specifically stated in the notice, continue to protect and maintain the Project, including those portions on which Work has been suspended.

In the event of suspension by the Port of Houston Authority, the Contractor shall be entitled to additional compensation as follows:

(a) Extra costs determined in accordance with Section 8.07, which are incurred by Contractor, its Subcontractors and Suppliers as a result of continuing to maintain dedicated personnel and Equipment and Materials at the Site at the Port of Houston Authority’s request during any suspension period, including for the purpose of safeguarding all Equipment and Materials and Work in progress; and

(b) Other reasonable and unavoidable extra costs determined in accordance with Section 8.07 which are directly related to any subsequent re-mobilization of the suspended Work.

Contractor shall assert a Claim for such costs and for any additional time for performance in accordance with Section 8. Payment of such additional costs shall be full and complete compensation for the suspension and Contractor shall not be entitled to payment of any additional costs or damages associated with such suspension. Failure to assert a Claim in accordance with Section 8 shall be deemed a waiver of any Claim for an extension of time, additional costs, damages or other relief due to a suspension.
9.04  **Termination by the Contractor:**

The Contractor may terminate the Contract if the Work is stopped for a period of ninety (90) consecutive days through no act or fault of the Contractor or a Subcontractor of any tier or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

(i) issuance of an order of a court or other Governmental Authority having jurisdiction which requires all Work to be stopped; or

(ii) an act of government, such as a declaration of national emergency which requires all Work to be stopped.

If one of the reasons described in Section 9.04(i) or (ii) exists, the Contractor shall give written notice to the Port Contract Representative of the Contractor’s intention to terminate, setting forth in detail the reason therefore. If the Port of Houston Authority fails to commence correction of the reason for termination stated in such notice within fourteen (14) days of receipt of such notice, the Contractor may, upon seven (7) additional days’ written notice to the Port Contract Representative, terminate the Contract and recover from the Port of Houston Authority payment as if the Port of Houston Authority had terminated for convenience pursuant to Section 9.01.

END OF GENERAL CONDITIONS SECTION 9
SECTION 10. PAYMENT

10.01 Schedule of Costs:

(a) The Contractor, after being notified of award of the Contract and before commencing any Work, shall submit to the Port Construction Representative a schedule of costs in such form as required by the Port of Houston Authority allocating the Contract Price to the various items of the Work. Such schedule shall be in a degree of detail acceptable to the Port Construction Representative and the costs reflected therein shall be substantiated by estimates of the Contractor prepared for its Bid/Proposal and shall reflect such other data as the Port of Houston Authority may request. Upon acceptance by the Port Construction Representative, such schedule (the “Schedule of Costs”) shall be the basis for the preparation and submission of monthly estimates.

The Port of Houston Authority reserves the right to reject all or any portion of the Schedule of Costs which does not accurately reflect the Work in reasonable detail or does not accurately reflect an appropriate cost, allocation or proportion of the Work. No Schedule of Costs will be accepted if it is unbalanced or front end loaded. If a Schedule of Costs has been initially accepted and subsequently used, but later found improper for any reason, sufficient funds shall be withheld from future billings to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor’s Work.

10.02 Progress Payments:

One month after commencement of field construction and each thirty (30) days thereafter during the term of the Contract, the Contractor shall submit an Estimate for Contract Payment in the form approved by the Port of Houston Authority estimating the value of Work performed as of that time and since the previous Estimate for Contract Payment, using as a basis therefor the Schedule of Costs accepted pursuant to Section 10.01. If the method of payment for the Contract is fixed price or partial fixed price, the Contractor’s proposed Estimate for Contract Payment shall reflect the percentage of completion in place of such fixed price Work. The Contractor shall have no right to request payment for any Work prior to actual in-place performance thereof nor shall the Contractor have the right to invoice the Port of Houston Authority any more frequently than once per month. In connection with each proposed Estimate for Contract Payment, the Contractor shall provide to the Port of Houston Authority, and such other persons as the Port of Houston Authority may designate, a copy of certified payrolls as set forth in Section 10.08 and a certificate to the effect that:

(i) the Work is progressing in accordance with the latest accepted Baseline Schedule or Revised Baseline Schedule (except as set forth in such certificate);

(ii) the quality of all Work performed and included in such proposed Estimate for Contract Payment is in compliance with the terms of the Contract Documents;

(iii) the Contractor is entitled to payment of the amount requested on such proposed Estimate for Contract Payment; and

(iv) the Contractor has paid, in accordance with Applicable Law, the applicable Subcontract, and the Contract Documents, all Subcontractors and Suppliers for Work previously invoiced, and the Work which is covered by such proposed Estimate for Contract Payment and all Work which is covered by previous Estimates for Contract Payment is free and clear of all Claims.

The Contractor shall provide with each proposed Estimate for Contract Payment the affidavits and releases required pursuant to Section 10.07 and such other information as required by the Port of Houston Authority.
Such Estimate for Contract Payment may not include requests for payment for portions of the Work for which the Contractor does not intend to pay to a Subcontractor or Supplier, unless such Work has been performed by others whom the Contractor intends to pay.

10.03 Inspector’s Review of Billings:

Prior to submitting each estimate for the purpose of substantiating any partial payment, the Contractor shall submit a proposed Estimate for Contract Payment to the Inspector for preliminary acceptance. The Contractor understands and agrees that such monthly estimates will be approximate only and that the Port of Houston Authority will make no attempt to verify exact measurements or quantities therein. As such, such preliminary estimates even if accepted by the Inspector are not binding on the Port Contract Representative or Port of Houston Authority and any Estimates for Contract Payment or payments based on such preliminary estimates are subject to adjustment and correction as set forth in the Contract Documents.

10.04 Nonpayment for Unincorporated Material and Work Not in Place:

Unless and except to the extent provided in the Special Conditions, the Port of Houston Authority shall make (i) no partial payments for Equipment and Materials not incorporated into the Work, even if such Equipment and Materials is stored at the Site, (ii) no partial payment for specially fabricated material, unless and until it is incorporated into the Work, and (iii) no partial payments for Work not physically in place at the Site, including without limitation Work associated with Submittals, Subcontractor oversight, and the like. Any exceptions to this rule, if any, will be noted in the Special Conditions.

10.05 Right to Withhold:

The Port of Houston Authority shall have the right, but not the obligation, to withhold all or any part of payment requested on any proposed Estimate for Contract Payment, or nullify the whole or part of a previously paid Estimate for Contract Payment, to protect the Port of Houston Authority from loss because of:

(i) Work that is defective or not in complete compliance with this Contract when such Work has not been remedied pursuant to this Contract;

(ii) any failure of the Contractor to perform Work in accordance with the provisions of this Contract;

(iii) third party suits, stop notices or Claims for which the Contractor is responsible pursuant to this Contract, including without limitation pursuant to any indemnification obligation hereunder, asserted or filed against any Port of Houston Authority Indemnitee or the Work, the Site or the Project, or any portion thereof;

(iv) damage to the Port of Houston Authority, any Subcontractor, Supplier, Port of Houston Authority Indemnitee or other contractor;

(v) failure of the Contractor to pay any Subcontractor or Supplier, or of Contractor to otherwise pay for any labor or Equipment and Materials;

(vi) any other damage to the Port of Houston Authority, including, without limitation, any additional costs associated with design professionals or other consultants;
(vii) evidence that the Work cannot be completed for the unpaid balance of the Contract Price;

(viii) evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

(ix) abandonment of the Site;

(x) failure of the Contractor to submit proper proposed Estimates for Contract Payment with all required attachments and supporting documentation; or

(xi) failure of the Contractor to comply with any requirement of the Contract.

The Port of Houston Authority shall not be deemed in default by reason of withholding payment while any of the above grounds remain uncured.

10.06 Overpayment for Defective or Over Estimated Work:

If investigation or inspection reveals that any Work was not performed in compliance with the Contract Documents, and either (i) the value of such Work was included in the current or a prior Estimate for Contract Payment or (ii) such Work was previously paid for by the Port of Houston Authority, then the Contractor shall not include the value of such Work in any subsequent Estimate for Contract Payment or be entitled to any further payment therefor and the Port of Houston Authority shall be entitled to withhold payment therefor from any payment due from the Port of Houston Authority to the Contractor or its surety.

10.07 Contractor's Submittal of Affidavit and Release:

As a condition precedent to the obligation of the Port of Houston Authority to make payment on any proposed Estimate for Contract Payment, the Contractor shall supply the Port of Houston Authority with affidavits and releases (including without limitation all types of security interest) in the form acceptable to the Port of Houston Authority. The affidavits and releases shall provide, at a minimum, that all amounts due and payable to the Contractor and each Subcontractor and Supplier, as of the date of such proposed Estimate for Contract Payment and as of the date of the last payment received by the Contractor and each Subcontractor and Supplier, as applicable, have been paid in full and that the Contractor and each Subcontractor and Supplier waives, releases and relinquishes any security interest and claim for payment to the extent of all prior Estimates for Contract Payment and, upon receipt of payment, the current Estimate for Contract Payment and any Claims associated with the Work for which such payments have been and are made. Such affidavits and releases shall be duly executed and acknowledged by the Contractor and each Subcontractor and Supplier expecting payment from Contractor in respect of such proposed Estimate for Contract Payment in order to assure an effective release of all claims to the maximum extent permitted by Applicable Law.

The Contractor shall submit with its final proposed Estimate for Contract Payment the Port of Houston Authority’s standard affidavit in respect of final payment for the Contractor and each Subcontractor and Supplier which sets out the amount of the final payment and acknowledges that such payment is full and final payment, provides that the Contractor and each Subcontractor and Supplier releases the Port of Houston Authority from any and all present or future claims against the Port of Houston Authority and provides that the Contractor and each Subcontractor and Supplier has fully paid all financial obligations in connection with the Project.
10.08  **Supporting Documents for Progress Payments:**

All documents required by the Contract to be submitted with each proposed Estimate for Contract Payment including, without limitation, releases, certified payrolls of Contractor’s employees and documentation evidencing appropriate insurance coverage shall be, and each must indicate on its face that it is, effective through the invoicing period with respect to which the Contractor is requesting payment. The Port of Houston Authority shall have no obligations to make any or all progress payments until the Contractor meets this requirement.

10.09  **Payment of Subcontractors and Suppliers:**

Contractor shall develop and implement a system and procedure for reviewing, processing, recording and paying Subcontractors and Suppliers which is fully consistent with the requirements to be fulfilled by the Contractor pursuant to the Contract Documents. Such procedures shall especially provide for strict adherence to all waiver and release requirements for Subcontractors and Suppliers of every tier as set forth in the Contract Documents.

In accordance with Applicable Law and each subcontract, the Contractor shall promptly pay each Subcontractor and Supplier, upon receipt of payment from the Port of Houston Authority, out of the amount paid to the Contractor on account of such person’s portion of the Work, pay each Subcontractor, Supplier and other persons supplying labor or Equipment and Materials in the performance of the Work, the amount to which said Subcontractor, Supplier or other person is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor’s, Supplier’s or other person’s portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor and Supplier, require each Subcontractor and Supplier to make payments in a similar manner to those providing labor and Equipment and Materials in connection with the Work.

The Port of Houston Authority has the right, but not the obligation, to request certified payrolls from subcontractors and/or to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and Suppliers amounts paid by the Port of Houston Authority to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence promptly, the Port of Houston Authority shall have the right, but not the obligation, to contact Subcontractors to ascertain whether they have been properly paid. The Port of Houston Authority shall not have an obligation to pay or to see to the payment of money to a Subcontractor, Supplier or other person supplying labor or Equipment and Materials in the performance of the Work.

10.10  **Conditions for Final Payment:**

As a condition precedent to the Contractor having any right to receive, and to the Port of Houston Authority having any obligation to pay, final payment, all requirements in the Contract Documents for final payment must have been met by the Contractor. Such requirements include, but are not limited to those set forth in Sections 6.10, 6.12 and 10.07. Payments which may otherwise become due to the Contractor at or following the point of Substantial Completion shall be withheld contingent upon receipt of the items set forth in Section 6.12 and all other requirements for Final Payment.

10.11  **Payment and Retainage:**

(a) Payment of the Contract Price and payment of the value, net of credits, pursuant to any Change Orders, constitutes full compensation to the Contractor for the performance and completion of the Work and the performance and observance by the Contractor of its obligations under this Contract, except to the extent otherwise stated expressly in this Contract. Based on the monthly estimates accepted by the Port Contract Representative, the Port of Houston Authority shall withhold five percent (5%) of each accepted Estimate for Contract Payment, and such retainage shall apply notwithstanding...
any Change Orders. The Port of Houston Authority shall have the right to retain the last five percent (5%) of monies earned under the Contract until the terms and conditions of the Contract are completely met and final acceptance of the entire Project is achieved.

(b) Acceptance of final payment by the Contractor, a Subcontractor or Supplier shall constitute a waiver of claims by that payee.

10.12 Title to Work:

Title to all Work, Equipment and Materials covered by each proposed Estimate for Contract Payment shall pass to the Port of Houston Authority no later than the time of payment therefor. The Contractor warrants that title to all Work (including all Equipment and Materials) covered by an Estimate for Contract Payment will pass to the Port of Houston Authority no later than the time of payment. The Contractor further warrants that upon submittal of an Estimate for Contract Payment all Work for which Estimates for Contract Payment have been previously issued and payments received from the Port of Houston Authority shall be free and clear of claims, security interests or encumbrances in favor of the Contractor, Subcontractors, Suppliers, or other persons or entities making a claim by reason of having provided labor, Equipment and Materials relating to the Work. Further, immediately upon the performance of any part of the Work, as between Contractor and the Port of Houston Authority, title thereto shall vest in the Port of Houston Authority. The vesting of such title shall not impose any obligations on the Port of Houston Authority or relieve Contractor of any of its obligations hereunder. The Contractor further warrants that it shall acquire no Work or Equipment and Materials, whether directly or through a Subcontractor, subject to an agreement under which a security interest is retained by the seller or otherwise imposed by the Contractor, any Subcontractor, or any other person or entity. Notwithstanding the passage of title, risk of loss or damage shall remain with Contractor until the Port of Houston Authority finally accepts the Work.

10.13 Payment Not Waiver or Acceptance of Work:

No payment made by the Port of Houston Authority pursuant to this Contract shall constitute a waiver of any claim or right (including without limitation claims or rights of the Port of Houston Authority in respect of warranty rights or indemnification obligations of the Contractor) the Port of Houston Authority may have against the Contractor, any Subcontractor or Supplier at that time or thereafter. No payment made by the Port of Houston Authority under this Contract shall be considered or deemed to represent that the Port of Houston Authority has inspected the Work or in any way checked the quality or quantity of the Work or that the Port of Houston Authority knows or should know or has ascertained how or for what purpose the Contractor has used sums previously paid to it by the Port of Houston Authority, nor shall any such payment be deemed to be or construed as an approval or acceptance of any Work. All payments (including without limitation final payment), withholdings and offsets shall be subject to correction and adjustment in subsequent progress reviews and payments or by offset or withholding.

10.14 Right to Audit:

(a) Contractor shall at all times implement and maintain such cost control systems and daily record keeping procedures as may be necessary to attain proper fiscal management and detailed financial records for all costs related to the Work, including detailed transaction reports and cost coding for Contractor's Subcontractors and Suppliers of every tier. To the maximum extent possible, all cost and pricing data shall be organized, maintained and presented in a format that is factually verifiable without the need to consider judgmental factors or estimates. Additionally, all cost and pricing data shall include the identification of any markups, vendor quotations, pricing methodologies or any other information that can be reasonably expected to contribute to the soundness or validity of either actual or estimated costs. To facilitate the settlement of Change Orders, Construction Change Directives, Change Proposals and Claims pursuant to the Contract, Contractor and its Subcontractors and Suppliers of every tier shall at all
times implement and maintain records sufficient for the Port Authority to verify all costs to the extent payable in accordance with the Contract.

Records to be maintained by the Contractor and its Subcontractors and Suppliers of every tier shall include, but are not limited to the following: (i) payroll records and payroll burden costs on actual wages and salaries (payroll taxes, insurance, benefits, etc.); (ii) daily time sheets and other records of personnel utilization on specific Work activities, including records on an hourly basis for personnel performing Construction Change Directive, Change Proposals, and Change Order activities and/or during any periods of overtime and/or during periods of premium pay for Work on holidays; (iii) invoices for Equipment and Materials, accounts payable and accounts receivable; (iv) all Drawings, Specifications, schedules, instructions, samples, receipts, subcontract documentation, purchase orders and vouchers; (v) all correspondence, minutes of meetings, daily logs including schedule status reports, memoranda and other similar data; (vi) all agreements, subcontracts and purchase orders for every tier; and (vii) records of all change orders submitted and/or approved for all subcontracts, sub-subcontracts and purchase orders of every tier. It is further understood that records subject to audit include Project-related records maintained by parent companies, affiliates, subsidiaries or other related parties.

(b) Contractor shall maintain the records set forth in Section 10.14(a) for a minimum of five (5) years after Final Payment.

(c) The Port of Houston Authority's authorized representatives shall be afforded access, in Houston, Texas, to the records described in Section 10.14(a) at all reasonable times for purposes of inspection and audit to the full extent as may be necessary to assist the Port of Houston Authority in the resolution of any issues pertaining to Construction Change Directives, Change Orders, Change Proposal, Claims or any other issues pertaining to the Work or the Project. This shall include, but not be limited to, providing the Port of Houston Authority's authorized representatives access, in Houston, Texas, at all reasonable times to records necessary for evaluation and verification of cost or pricing data with respect to: (i) all negotiated Change Orders to this Contract; (ii) all subcontracts and purchase orders, including change orders or modifications thereto; (iii) Contractor's compliance with all provisions of the Contract Documents, including those relating to lump-sum or fixed price contracts, subcontracts and purchase orders; (iv) all costs described in the Contract; (v) instances where the parties are unable to resolve cost data or scheduling issues pertaining to pending Construction Change Directives or Change Proposals; and (vi) instances where the parties are unable to resolve cost data or scheduling issues pertaining to any pending Claims. Without limiting the foregoing, the Port of Houston Authority shall also have the right to request that the Contractor provide such information to the Port of Houston Authority upon the Port of Houston Authority providing a notice to the Contractor requesting such information and in such event the Contractor shall be obligated to provide such information to the Port of Houston Authority within five (5) Working Days of the Port of Houston Authority making such request.

It is expressly understood that the Port of Houston Authority's audit rights as set forth in this Section 10.14 include the right to audit all accounting and Project-related records as defined in Section 10.14(a) belonging to the Contractor, its Subcontractors and Suppliers which may directly or indirectly relate to specific Project-related accounting concerns, including but not limited to any of the following: (1) the submittal of Change Proposals or Claims; (2) unilateral implementation of value engineering without acceptance or without passing on the cost benefits to the Port of Houston Authority; (3) Port of Houston Authority accepted "add alternatives" not provided or installed where the Port of Houston Authority has requested and/or paid for such alternatives; (4) payments for performance bonds or insurance premiums, if applicable; (5) specified quantity or quality of Equipment and Materials not installed or utilized; (f) specified construction methods not followed; (6) specified services not provided; (7) contracted Work not performed or completed; (8) Port of Houston Authority provided items not credited; (9) charges for overtime, including weekends and public holidays; (10) overruns and underruns with respect to allowance items; (11) labor burden rates to hours in excess of forty (40) hours per week; (12) constructive and actual accelerations; (13) constructive and active suspensions; and (14) and disruptions of craft labor.
It is further expressly understood that the Port of Houston Authority's audit rights as set forth in this Section 10.14 do not include the right to audit costs which are included: (y) within mutually agreed lump-sum prices, fixed fees, unit costs, fixed hourly rates or fixed percentages (such as labor burden percentage rates); or (z) within fixed price subcontracts or purchase orders accepted by the Port Authority.

(d) Contractor shall produce all data in the form maintained and used by Contractor in its normal course of business unless otherwise requested by the Port of Houston Authority. Contractor agrees that, if any Project-related information is maintained by Contractor in a computerized format, such information will be made available to the Port of Houston Authority in a readily accessible and useable format, including when required by providing access to the Port of Houston Authority to any software or database necessary to access, use and audit the data, within three (3) Working Days after a written request by the Port of Houston Authority.

(e) In addition to the Port of Houston Authority's other right to access data from the Subcontractors and Suppliers of every tier, Contractor shall be required to submit cost or pricing data described in this Section 10.14 on each Change Order requested by and/or accepted for all the Subcontractors and Suppliers of every tier.

Contractor shall require all Subcontractors and Suppliers of every tier to comply with the provisions of this Section 10.14, by insertion of this "Right to Audit" clause (Section 10.14) into each Project-related subcontract and purchase order of all tiers. In this regard, the Port of Houston Authority shall have the right to act as Contractor's authorized representative for the purpose of conducting audits in accordance with this Section 10.14 of all accounting and Project-related records in the possession of the Subcontractors and Suppliers of every tier. It is specifically understood, however, that the Port of Houston Authority has no contractual relationship with any Subcontractor or Supplier of any tier. Likewise, it shall remain the Contractor's financial and contractual responsibility to resolve all such issues with its Subcontractors and Suppliers of every tier.

(f) In order to permit evaluations and verifications as described in this Section 10.14, Contractor shall provide adequate and appropriate work space in Houston, Texas, for the Port of Houston Authority's authorized representatives, including allowing photocopying of any and all records reasonably requested. Upon request, Contractor shall also fully cooperate in arranging interviews with Contractor's employees and shall require all Subcontractors and Suppliers of every tier to likewise fully cooperate pursuant to this Section 10.14.
10.15 **Offset:**

If the Port of Houston Authority is entitled to reimbursement or payment from the Contractor under or pursuant to the Contract Documents, such payment shall be made promptly upon demand by the Port of Houston Authority. Notwithstanding anything contained in the Contract Documents to the contrary, if the Contractor fails to promptly make any payment due the Port of Houston Authority, or if the Port of Houston Authority incurs any costs and expenses to cure any default of the Contractor or to correct defective Work, or if the Contractor owes the Port of Houston Authority money for any other reason, the Port of Houston Authority, without waiver or limitation of any of its other rights or remedies under this Contract and Applicable Law, shall have the right but not the obligation to from time to time deduct from any amounts due or owing by the Port of Houston Authority to the Contractor or its surety any and all amounts owed by the Contractor or its surety to the Port of Houston Authority, or issue a written notice to the Contractor reducing the Contract Price by an amount equal to that which the Port of Houston Authority is entitled.

**END OF GENERAL CONDITIONS SECTION 10**
SECTION 11.  GENERAL PROVISIONS

11.01  Taxes:

(a)  The Port of Houston Authority, being a political subdivision of the State of Texas, is exempt from all sales taxes on material purchased in Texas and incorporated into a Project. The Contractor and any Subcontractor or Supplier must have or obtain all necessary permits and certificates to purchase on a tax-free basis any material purchased in Texas and incorporated into the Project.

(b)  The Contract Price includes all corporate income tax, employee benefit taxes for all Work (whether by the Contractor, Supplier, Subcontractor or sub-subcontractor), and taxes imposed upon the wages of the Contractor's employees, agents and representatives. The Contractor shall pay as and when due all taxes levied or imposed upon the Contractor relating to performance and completion by the Contractor of the Work.

11.02  Conflicts of Interest:

The Contractor and its officers, directors, shareholders, members, partners, employees or agents are positively forbidden from giving or lending money, or any other thing of value, to the Port of Houston Authority, any Port of Houston Authority Commissioner, or to any Port of Houston Authority officer, director, employee or agent or to any member of the family of any of the foregoing.

Should any of the above enumerated persons connected with the Port of Houston Authority have a direct or indirect monetary interest in the Contractor's company or parent company, then such person must disclose in writing the nature and extent of such interest to the Port of Houston Authority with any Bid/Proposal submitted.

11.03  Prevailing Wage Scale:

All on-Site employees and employer’s delivery persons shall be paid no less than the wages shown and, where shown, fringe benefits shown on the Harris County Building Construction Prevailing Wage Rates and Worker Classifications, Harris County Road Bridge Construction Prevailing Wage Rates and Worker Classifications and the Port of Houston Authority's Prevailing Wage Scale Rates for Hydraulic Dredging Operations, a copy of which is included in the Contract Documents. See such schedule for further details. However, where there is a contract between the employer and his employees or their respective representatives governing fringe benefits, the fringe benefits shall be paid in accordance with such contract. Contractor should be aware that Texas Government Code Chapter 2258, Prevailing Wage Rates, provides, among other things, that:

(i)  If the Contractor or a Subcontractor violates this law by underpayment of wages, the Contractor must pay to the Port of Houston Authority $60.00 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates required by the Contract. This money becomes the property of the Port of Houston Authority.
The Contractor and each of its Subcontractors must keep a record showing:

(a) the name and occupation or each worker employed by the Contractor or Subcontractor in the construction of the Project; and

(b) the actual per diem wages paid to each worker.

These records must be open to inspection by the Port of Houston Authority at all reasonable hours.

Within 30 days of receipt of a complaint, the Port of Houston Authority shall make a determination whether good cause exists to believe that the Contractor or Subcontractor has committed a violation of the law. If good cause is found to exist that a violation has been committed, the law requires the Port of Houston Authority to retain any amounts due under the Contract pending a final determination.

If the Contractor or Subcontractor and the affected worker(s) do not reach agreement within 14 days of notice of the Port of Houston Authority’s determination, the issues must be submitted to binding arbitration in accordance with the Texas General Arbitration Act.

Any awards made by the arbitrator in favor of the worker(s) shall be paid out of the Contractor’s funds held by the Port of Houston Authority. If the amounts held by the Port of Houston Authority are insufficient, the worker has a right of action against the Contractor or Subcontractor and the surety of the Contractor or Subcontractor to recover the amount owed, reasonable attorney’s fees and court costs.

The Port of Houston Authority is not a party to the arbitration proceedings.

No officer, agent or employee of the Port of Houston Authority is liable in a civil action for any act or omission implementing or enforcing the applicable law unless the action is made in bad faith.

The Contractor is entitled to rely on a certificate by a Subcontractor as to the payment of all sums due to those working for and under that Subcontractor until the contrary has been determined.

The Prevailing Wage Scale Rates and Worker Classifications shall be posted at the Site in a prominent accessible location.

11.04 Assignment of Antitrust Causes of Action:

By submitting a Bid/Proposal or entering into a Contract with the Port of Houston Authority, the Contractor offers and agrees to assign to the Port of Houston Authority all causes of action it may have under the Antitrust Laws of Texas and/or Antitrust Laws of the United States. Such assignments shall be made and become effective when the Port of Houston Authority tenders final payment to the Contractor without any further action or acknowledgement by the parties.

11.05 Small Business Development Program:

The Port of Houston Authority has a Small Business Development Program which was created to help implement the Port of Houston Authority’s objectives of promoting economic development and business opportunities for all sectors of the local economy. Contractor is required to use good-faith efforts
to meet certified small business participation goals. Contractor shall submit a quarterly report via the B2GNow link located in the Small Business, Contract Compliance section of the Port of Houston Authority’s website (http://www.portofhouston.com/). Contractor shall report all payments to any small business Subcontractors (including any small business material suppliers) through the audit tab located in the B2GNow application for confirmation by such Subcontractors. Contractor may consult the B2GNow Vendor Guide for assistance with the B2GNow application. If no payments to small business Subcontractors occur during the quarter, Contractor shall so indicate in the B2GNow application. Contractor shall report all small business subcontracting or material supply activity until Project is complete and closed. Contractor shall provide such other information regarding its small business participation in the form and at the times requested by the Port of Houston Authority.

The Small Business Development Program is administered by its Policies and Procedures (most recent version). Contractor should be aware of the contents of the Small Business Development Program Policy and Procedures. Specifically, Contractor should know that its failure to adhere to the requirements of the Small Business Development Program may result in a default and termination of the contract.

In addition to other provisions of the Small Business Development Program, Contractor should be expressly aware of the obligations to:

(i) adhere to Port of Houston Authority’s Non-Discrimination Mandate;
(ii) submit utilization reports to the Port of Houston Authority on small business participation;
(iii) make good-faith efforts to meet a contract small business participation goal or to maintain small business participation; and
(iv) adhere to the dispute resolution mechanisms of the Small Business Development Program.

11.06 Contractor’s Insurance Requirements:

(a) The Contractor shall, at all times during the performance of Work under this Contract and through the expiration of the period set forth in Section 7.04, provide and require all Subcontractors to provide insurance coverage with companies lawfully authorized to do business in Texas and acceptable to the Port of Houston Authority, which coverage will protect the Contractor from claims set forth below which may arise out of or result from the Contractor’s operations under the Contract Documents and for which the Contractor may be legally liable, whether such operations are by the Contractor or a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and meeting not less than the minimum requirements shown below. Such insurance is to be provided at the sole cost of the Contractor and all Subcontractors.

Any additional coverage in kind or limits will be set out in the Special Conditions.

Kinds of Claims:

1. claims under workers’ or workmen’s compensation, disability benefit and other similar employee benefit acts which are applicable to the Contractor’s Work to be performed pursuant to Section 11.06(b);
2. claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor’s employees;
3. claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor’s employees;
4. claims for damages insured by usual personal injury liability coverage which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person;

5. claims for damages, other than to the Contractor’s Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

6. claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and

(b) Workers’ Compensation Insurance Coverage.

(i) The following definitions shall apply for purposes of this Section 11.06(b):

Certificate of coverage ("certificate") – A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers’ compensation insurance coverage for the person’s or entity’s employees providing services on the Project, for the duration of the Project.

Duration of the Project – includes the time from the beginning of the Work on the Project until the Contractor's/person's work on the Project has been completed and accepted by the Port of Houston Authority.

Persons providing services on the Project ("subcontractor" in Texas Labor Code, §406.096) – includes all persons or entities performing all or part of the Work and services the Contractor has undertaken to perform on the Project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, Subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the Project.

"Services" includes, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to the Project. "Services" does not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

(ii) The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the Project, for the duration of the Project.

(iii) The Contractor must provide a certificate of coverage to the Port of Houston Authority prior to being awarded the Contract.

(iv) If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the Project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the Port of Houston Authority showing that coverage has been extended.

(v) The Contractor shall obtain from each person providing services on the Project, and provide to the Port of Houston Authority:
(1) a certificate of coverage, prior to that person beginning Work on the Project, so the Port of Houston Authority will have on file certificates of coverage showing coverage for all persons providing services on the Project; and

(2) no later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project.

(vi) The Contractor shall retain all required certificates of coverage for the duration of the Project and for one year thereafter.

(vii) The Contractor shall notify the Port of Houston Authority in writing by certified mail or personal delivery, within ten (10) calendar days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project.

(viii) The Contractor shall post on each Project Site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the Project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

(ix) The Contractor shall contractually require each person with whom it contracts to provide services on the Project, to:

(1) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the Project, for the duration of the Project;

(2) provide to the Contractor, prior to that person beginning work on the Project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the Project, for the duration of the Project;

(3) provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

(4) obtain from each other person with whom it contracts, and provide to the contractor:

(a) a certificate of coverage, prior to the other person beginning Work on the Project; and

(b) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

(5) retain all required certificates of coverage on file for the duration of the Project and for one year thereafter;

(6) notify the Port of Houston Authority in writing by certified mail or personal delivery, within ten (10) calendar days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project; and
11.07 Insurance:

Proof of Insurance. Prior to the commencement of any Work under this Contract, Contractor shall furnish the Port Authority with certificates of insurance, in compliance with Applicable Law, showing Contractor’s procurement of the insurance required hereunder. Contractor agrees to review each certificate, and hereby warrants to the Port Authority the accuracy of all information shown on each Insurance Certificate furnished. The Port Authority shall have no duty to pay or perform under this Contract until such Insurance Certificates have been provided to the Port Authority, and no officer or employee, other than Port Authority Risk Management, shall have authority to waive this requirement.

Form of Policy. The Port Authority reserves the right to review the insurance requirements of this Section during the effective period of the Contract, and any extension or renewal thereof and to modify insurance coverage and limits when deemed necessary and prudent by its Risk Management Department based upon changes in statutory law, court decisions, or circumstances surrounding this Contract, but in no instance will the Port Authority allow modification whereupon the Port Authority may incur increased risk.

Deductibles. A Contractor’s financial integrity is of interest to the Port Authority. Therefore, subject to Contractor’s right to maintain reasonable deductibles in such amounts as are approved by Port Authority Risk Management, Contractor shall obtain and maintain in full force and effect for the duration of this Contract, and any extension thereof, at Contractor’s sole expense, insurance coverage written on an occurrence basis, by companies authorized and admitted to do business in the State of Texas and rated A- or better by A.M. Best Company and/or otherwise acceptable to the Port Authority, in the following types and amounts. Any additional coverage in kind will be set out in the Special Conditions.

<table>
<thead>
<tr>
<th>COVERAGE TYPE</th>
<th>AMOUNTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Workers’ Compensation</td>
<td>Statutory</td>
</tr>
<tr>
<td>Employers’ Liability</td>
<td>$500K/$500K/$500K</td>
</tr>
<tr>
<td>U.S. Longshore &amp; Harbor Workers’ Act</td>
<td>Statutory</td>
</tr>
<tr>
<td>(If exposure exists)</td>
<td></td>
</tr>
</tbody>
</table>
2) Commercial General Liability Insurance  $1 Million per Occurrence
   a. Premises Operations  $2 Million Aggregate
   b. Independent Contractors
   c. Products/Completed Operations
   d. Personal Injury
   e. Contractual Liability

3) Business Automobile Liability  $1 Million per Occurrence
   a. Any auto

4) Umbrella/Excess Liability  $2,000,000 per Occurrence/Aggregate
   Umbrella/excess insurance shall have the same inception and expiration dates as the underlying liability policies and with coverage no less broad than those in the primary policies or program.

5) Builder’s Risk  Please see (i) below for amount
   On an all risk policy form covering, without limitation, perils of fire and extended coverage and physical loss or damage, including without duplication of coverage, theft, flood, vandalism, malicious mischief, collapse, falsework, temporary buildings and debris removal including demolition occasioned by enforcement of any Applicable Laws, and covering reasonable compensation for the Port of Houston Authority’s and Design Consultant’s services and reasonable expenses of the Port of Houston Authority and Design Consultant which are required as a result of such loss.

   (i) Amount is the initial Contract Price and any subsequent modifications thereto for the entire Work and Equipment and Materials stored at the Site, stored off-Site or being shipped to the Site, including materials supplied by the Port of Houston Authority, on a replacement cost basis without voluntary deductibles

**Policy Endorsements.** The Port Authority shall be entitled, upon request and without expense, to receive copies of the policies and all endorsements thereto as they apply to the limits required by the Port Authority, and may make a reasonable request for deletion, revision, or modification of particular policy terms, conditions, limitations or exclusions (except where policy provisions are established by law or regulation binding upon either of the parties hereto or the underwriter of any such policies). Upon such request by the Port Authority, the Contractor shall exercise reasonable efforts to accomplish such changes in policy coverage, and shall pay the cost thereof. In addition, Contractor, upon request, shall promptly: permit the Port Authority to inspect the originals of all required insurance at the offices of Contractor or its insurance broker; and authorize the Port Authority and/or the Port Authority’s insurance broker to communicate directly (by telephone, email, or in person) with Contractor’s insurance broker for the purpose of verifying Contractor’s compliance with the Contract Documents or to answer questions concerning Contractor’s insurance.

Contractor agrees that with respect to the above required insurance, all insurance policies of Insurance will contain the following required provisions.

1) To the fullest extent allowed by applicable Law, name the Port Authority and its Commissioners, officers, employees, agents, and other legal representatives as additional insureds (as the interests of each insured may appear) as to the full extent of all applicable coverages with respects to operations and activities of, or on behalf of, the named insured performed under contract with the Port Authority, with the exception of workers’ compensation policy, but in each instance such additional insured status shall be only to the extent of the Contractor’s indemnification obligations under the Contract Documents. Builder’s risk policy shall name the Port Authority as a named insured and “loss payee”;
2) The Contractor’s insurance shall be deemed primary with respect to any insurance or self-insurance carried by the Port Authority for liability arising out of operations under the Contract with the Port Authority.

3) Inasmuch as the Port Authority and Contractor intend that all of Contractor’s insured losses and liabilities fall upon Contractor’s insurers, without recourse against the Port Authority, Contractor agrees to cause of all its policies of insurance maintained in force or procured by Contractor during the Work to provide, if necessary by endorsement, that each such insurer fully waives subrogation against the Port Authority.

4) Contractor hereby releases the Port from and waives all Claims it may have against the Port to the extent any of such Claims are covered by insurance required to be furnished by Contractor or any Subcontractors hereunder, whether or not Contractor actually obtains such insurance, and EVEN IF SUCH CLAIMS ARISE OUT OF, RELATE TO OR ARE BASED UPON THE PORT AUTHORITY’S OWN NEGLIGENCE OR OTHER TORTIOUS CONDUCT, BAD FAITH, ARBITRARY OR CAPRICIOUS CONDUCT, INEQUITABLE CONDUCT, BREACH OF CONTRACT OR OTHER FAULT, HOWEVER CHARACTERIZED, OR STRICT LIABILITY WITHOUT REGARD TO FAULT.

Change Notification. All policies for which the Port Authority is a named insureds or additional insureds shall be endorsed to require the insurer to provide the Port Authority with at least thirty (30) days prior written notice of any reduction in the limit of liability by endorsement of the policy or other material change in coverage, cancellation, or non-renewal of the insurance coverage required under this Contract. For policies on which the Port Authority is neither a named insured nor an additional insured, Contractor shall provide the Port Authority with at least thirty (30) days prior written notice of any reduction in the limit of liability by endorsement of the policy or other material change in coverage, cancellation, or non-renewal of the insurance coverage required under this Contract. All notices shall be given to the Port Authority at the following address:

Port of Houston Authority
111 East Loop North
Houston, TX 77029
Attn: Risk Manager

Failure to Maintain. If the Contractor fails to purchase and maintain insurance required under the Contract Documents, the Port Authority may, but is not obligated to, purchase such insurance on behalf of the Contractor and shall be entitled, at the Port Authority’s election, to offset the costs thereof from amounts due to the Contractor or to reimbursement by the Contractor upon demand.

Limits of Liability. Nothing herein contained shall be construed as limiting in any way the extent to which Contractor may be held responsible for payments of damages to persons or property resulting from Contractor’s or its subcontractors’ performance of the work covered under this Contract.

Contract Obligations. The insurance requirements set forth herein shall not limit or define the obligations of Contractor as set forth elsewhere in this Contract.
**Subcontractor Requirements.** Upon Port Authority’s request, Contractor shall provide Port Authority with proof of insurance from each subcontractor to be utilized by Contractor under this Contract. This certificate shall set forth the types and levels of insurance currently maintained by subcontractors and shall, to the extent reasonably practicable, be consistent with the requirements of this Section 11.07. Port Authority may, in its sole discretion, object to any subcontractor that Port Authority determines does not maintain appropriate insurance coverage given the nature of its work, in which event Contractor shall find a replacement, acceptable to Port Authority in its reasonable discretion.

**11.08 Indemnification by Contractor:**

TO THE MAXIMUM EXTENT ALLOWED BY LAW, THE CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS ALL PORT OF HOUSTON AUTHORITY INDEMNITEES, FROM AND AGAINST ANY AND ALL CLAIMS, DEMANDS, SUITS, CAUSES OF ACTION, SETTLEMENTS, LIABILITIES, COSTS, EXPENSES, DAMAGES, LOSSES, FINES, AND JUDGMENTS (INCLUDING, WITHOUT LIMITATION, COURT COSTS, EXPERTS’ FEES AND ATTORNEY’S FEES) (COLLECTIVELY, “LOSSES”), WHETHER ARISING IN EQUITY, AT COMMON LAW, OR BY STATUTE, INCLUDING WITHOUT LIMITATION THE TEXAS DECEPTIVE TRADE PRACTICES ACT (AS AMENDED) OR SIMILAR STATUTE OF OTHER JURISDICTIONS, OR UNDER THE LAW OF CONTRACTS, TORTS (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE AND STRICT LIABILITY WITHOUT REGARD TO FAULT) OR PROPERTY,

(I) FOR BODILY INJURY OR DEATH OF AN EMPLOYEE OF CONTRACTOR OR ANY OF ITS AGENTS OR SUBCONTRACTORS, EVEN IF SUCH BODILY INJURY OR DEATH IS CAUSED IN WHOLE OR IN PART BY THE NEGLIGENCE OR OTHER TORTIOUS CONDUCT, BAD FAITH, ARBITRARY OR CAPRICIOUS CONDUCT, INEQUITABLE CONDUCT, BREACH OF CONTRACT OR WARRANTY, BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR OTHER FAULT, HOWEVER CHARACTERIZED, OR STRICT LIABILITY WITHOUT REGARD TO FAULT OF ANY PORT AUTHORITY INDEMNITEE; AND

(II) OF EVERY KIND OR CHARACTER (INCLUDING, WITHOUT LIMITATION, CLAIMS FOR PROPERTY DAMAGE, AND ECONOMIC LOSS), SAVING ONLY THOSE ENCOMPASSED BY SECTION 11.08(I) ABOVE, AND EVEN IF ANY SUCH LOSSES ARE DUE IN PART TO ANY PORT OF HOUSTON AUTHORITY INDEMNITEES’ CONCURRENT (BUT NOT SOLE) NEGLIGENCE OR OTHER TORTIOUS CONDUCT, BAD FAITH, ARBITRARY OR CAPRICIOUS CONDUCT, INEQUITABLE CONDUCT, BREACH OF CONTRACT OR WARRANTY, BREACH OR VIOLATION OF A STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR OTHER FAULT, HOWEVER CHARACTERIZED, OR STRICT LIABILITY WITHOUT REGARD TO FAULT; PROVIDED, HOWEVER THAT CONTRACTOR'S OBLIGATION UNDER THIS SECTION 11.08(II) SHALL BE LIMITED TO THE PERCENTAGE OF DAMAGES CAUSED BY THE CONTRACTOR'S (OR ANY OF ITS EMPLOYEES', AGENTS' OR SUBCONTRACTORS' OF ANY TIER) OWN NEGLIGENCE OR OTHER FAULT, BREACH OF CONTRACT OR WARRANTY, BREACH OR VIOLATION OF STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR STRICT LIABILITY WITHOUT REGARD TO FAULT;

IN EACH INSTANCE, ARISING IN FAVOR OF OR BROUGHT BY ANY OF THE CONTRACTOR'S EMPLOYEES, AGENTS, SUBCONTRACTORS, SUPPLIERS OR REPRESENTATIVES, OR BY ANY GOVERNMENTAL AUTHORITY OR ANY OTHER THIRD PARTY, AND BASED UPON, IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE WORK, THE CONTRACTOR'S FAILURE TO COMPLY WITH THE CONTRACT DOCUMENTS, OR THE CONTRACTOR'S ACTIONS...
OR IN ACTIONS UNDER THE CONTRACT DOCUMENTS, INCLUDING WITHOUT LIMITATION ANY 
FAILURE TO PAY TAXES OR FAILURE TO COMPLY WITH ANY APPLICABLE LAWS.

THE INDEMNIFICATION OBLIGATION OF THIS SECTION 11.08 OR UNDER SECTION 11.09 
SHALL APPLY REGARDLESS OF THE AMOUNT OF INSURANCE COVERAGE HELD BY THE 
CONTRACTOR, INCLUDING WITHOUT LIMITATION ANY SUCH COVERAGE UNDER ANY 
WORKER’S COMPENSATION ACT, DISABILITY ACT, OR OTHER ACT OR LAW WHICH WOULD 
LIMIT THE AMOUNT OR TYPE OF DAMAGES, COMPENSATION, OR BENEFITS PAYABLE BY OR 
FOR THE CONTRACTOR, AND SHALL NOT BE LIMITED BY ANY INSURANCE CARRIED OR 
PROVIDED BY THE CONTRACTOR IN ACCORDANCE WITH THE CONTRACT DOCUMENTS OR 
OTHERWISE.

11.09 Intellectual Property and Technology Indemnity:

TO THE MAXIMUM EXTENT ALLOWED BY LAW, THE CONTRACTOR SHALL INDEMNIFY 
AND HOLD HARMLESS ALL PORT OF HOUSTON AUTHORITY INDEMNITEES FROM AND AGAINST 
ANY AND ALL LOSSES, WHETHER ARISING IN EQUITY, AT COMMON LAW, OR BY STATUTE, 
INCLUDING, WITHOUT LIMITATION, THE TEXAS DECEPTIVE TRADE PRACTICES ACT OR SIMILAR 
STATUTE OF OTHER JURISDICTIONS, OR UNDER THE LAW OF CONTRACTS, TORTS 
(INCLUDING, WITHOUT LIMITATION, NEGLIGENCE AND STRICT LIABILITY WITHOUT REGARD TO 
FAULT) OR PROPERTY, OF EVERY KIND OR CHARACTER (INCLUDING, WITHOUT LIMITATION, 
FOR PERSONAL INJURY (INCLUDING EMOTIONAL DISTRESS), REAL OR PERSONAL PROPERTY 
DAMAGE, OR ECONOMIC LOSS), ARISING IN FAVOR OF OR BROUGHT BY ANY OF 
CONTRACTOR’S EMPLOYEES, AGENTS, SUBCONTRACTORS, SUPPLIERS, OR 
REPRESENTATIVES, OR BY ANY GOVERNMENTAL AGENCY OR ANY OTHER THIRD PARTY, 
BASED UPON, IN CONNECTION WITH, RELATING TO OR ARISING OUT OF:

(I) INFRINGEMENT OR THE IMPROPER USE OF COPYRIGHTED MATERIAL EVEN IF 
SUCH LOSSES ARE DUE TO ANY PORT OF HOUSTON AUTHORITY INDEMNITEE’S 
OWN NEGLIGENCE OR OTHER TORTIOUS CONDUCT, BAD FAITH, ARBITRARY 
OR CAPRICIOUS CONDUCT, INEQUITABLE CONDUCT, BREACH OF CONTRACT 
OR WARRANTY, VIOLATION OF STATUTE, OR OTHER FAULT, HOWEVER 
CHARACTERIZED, OR STRICT LIABILITY WITHOUT REGARD TO FAULT;

(II) INFRINGEMENT OR THE IMPROPER USE OF PATENTS, TRADEMARKS, TRADE 
SECRETS, OR OTHER PROPRIETARY OR INTELLECTUAL PROPERTY RIGHTS 
WHICH MAY OCCUR IN CONNECTION WITH CONTRACTOR’S (OR ANY 
SUBCONTRACTORS’, SUPPLIERS’, EMPLOYEES’, OR OTHER PERSON DIRECTLY 
OR INDIRECTLY EMPLOYED BY THEM OR FOR WHOM ACTIONS THEY MAY BE 
LIABLE) PERFORMANCE OF THE WORK, OR THE OWNERSHIP OR USE OF THE 
WORK OR ANY PART THEREOF PROVIDED BY CONTRACTOR (OR ANY 
SUBCONTRACTORS, SUPPLIERS, EMPLOYEES, OR OTHER PERSON DIRECTLY 
OR INDIRECTLY EMPLOYED BY THEM OR FOR WHOM ACTIONS THEY MAY BE 
LIABLE); PROVIDED THAT (Y) CONTRACTOR SHALL HAVE NO INDEMNITY 
OBLIGATIONS HEREUNDER WITH RESPECT TO ANY CLAIM ARISING OUT OF USE 
OF EQUIPMENT AND MATERIALS IN COMBINATION WITH DEVICES OR 
PRODUCTS OTHER THAN AS INTENDED IN CONNECTION WITH THE WORK, AND 
(Z) CONTRACTOR’S INDEMNIFICATION OBLIGATION OTHERWISE SHALL APPLY 
EVEN IF SUCH LOSSES ARE DUE TO ANY PORT OF HOUSTON AUTHORITY 
INDEMNITEE’S OWN NEGLIGENCE OR OTHER TORTIOUS CONDUCT, BAD FAITH, 
ARBITRARY OR CAPRICIOUS CONDUCT, INEQUITABLE CONDUCT, BREACH OF 
CONTRACT OR WARRANTY, VIOLATION OF STATUTE, OR OTHER FAULT, 
HOWEVER CHARACTERIZED, OR STRICT LIABILITY WITHOUT REGARD TO
FAULT, BUT SHALL BE LIMITED TO THE PERCENTAGE OF DAMAGES CAUSED BY THE CONTRACTOR’S (OR ANY OF ITS EMPLOYEES’, AGENTS’ OR SUBCONTRACTORS’ OF ANY TIER) OWN NEGLIGENCE OR OTHER FAULT, BREACH OF CONTRACT OR WARRANTY, BREACH OR VIOLATION OF STATUTE, ORDINANCE, GOVERNMENTAL REGULATION, STANDARD, OR RULE, OR STRICT LIABILITY WITHOUT REGARD TO FAULT.

SHOULD ANY SUCH LOSSES MATERIALLY IMPAIR CONTRACTOR’S PERFORMANCE OF THE WORK OR CONTINUED OPERATIONS THEREOF, THEN CONTRACTOR SHALL, AT ITS OWN EXPENSE, TIMELY PROCURE THE RIGHT TO CONTINUE ITS PERFORMANCE OF THE WORK SO AS NOT TO MATERIALLY IMPAIR THE CONTRACT TIME OR SUCH CONTINUED OPERATIONS OF THE WORK.

11.10 **No Estoppel or Waiver:**

The Contractor agrees that the Port of Houston Authority shall not be precluded or estopped by any action taken or thing done, written or oral, including, but not limited to, inspections made, payments made, or final completion of the Work, from showing that the true and correct amount and character of the Work done and Equipment and Materials furnished by the Contractor do not in fact conform to the Specifications or other Contract Documents. The Contractor also agrees that the Port of Houston Authority shall not be precluded or estopped because of any action taken or not taken, from demanding and recovering from the Contractor any damages resulting therefrom or from the Contractor’s other failure to comply with the Contract Documents.

Furthermore, no action or failure to act by the Port of Houston Authority shall constitute a waiver of any right or duty afforded to the Port of Houston Authority under the Contract or otherwise by law, nor shall any such action or failure to act constitute acceptance of, approval of or acquiescence in any breach thereunder, except as may be specifically agreed to in writing and signed by the Port Contract Representative.

11.11 **No Election of Remedies:**

It is expressly agreed that pursuit by the Port of Houston Authority of any one or more of the remedies provided in the Contract Documents or otherwise available at law or in equity shall not constitute an election of remedies by the Port of Houston Authority.

11.12 **No Interference:**

Neither the Port of Houston Authority’s exercise of any of its rights or remedies under the Contract Documents (including, without limitation, ordering Changes in the Work, or directing suspension, rescheduling, re-execution or correction of the Work), regardless of the extent or frequency of the Port of Houston Authority's exercise of such rights or remedies, nor the Port of Houston Authority's early occupancy, if any, of the Project, nor the Port of Houston Authority's operations at and around the Site shall be construed as a breach, violation of Contractor's rights, or as interference with the Contractor's performance of the Work or entitle the Contractor to a Claim for additional compensation, whether in the form of damages, an adjustment to the Contract Price, or otherwise. Any Claims for an adjustment to the Contract Time or that the Contractor is relieved of its obligations to complete the Work within the Contract Time shall be asserted in accordance with Section 8.11.

11.13 **Notice:**

For purposes of the Contract, it is agreed to and understood by the parties that written notice to the Contractor shall be deemed to have been received on the day when such notice is delivered in person.
or by telefax to the Contractor’s Field Supervisor or the Contractor’s local office. Notices sent by U. S. mail shall be deemed to have been received on the third postal delivery day after the date postmarked on the envelope containing such notice.

Notice to the Port of Houston Authority shall be ineffective unless given in writing and shall be deemed to have been received on the date it is received by the Port Contract Representative (unless the Contract Documents provide that notice be given to another official of the Port of Houston Authority in which case such notice shall be deemed to have been received on the date it is received by such person). Notice to the Port of Houston Authority shall be addressed as follows:

The Port of Houston Authority
ATTN: Port Contract Representative (name and title of the individual designated as such in and pursuant to the Special Conditions)
111 E. Loop North
Houston, Texas 77029-4327

11.14 Contractor’s Qualifications:

In entering into this Contract, Contractor represents and warrants that:

(i) it is financially solvent, able to pay its debts as they mature and possesses a sufficient working capital to complete the Work and perform its obligations under the Contract Documents;

(ii) it has ability, experience and personnel to perform the Work defined herein in accordance with all terms of the Contract Documents, including the Contract Time;

(iii) it can furnish the labor, plant, tools, supplies, and Equipment and Materials required to complete the Work and perform its obligations hereunder;

(iv) it is familiar with all Applicable Laws which may in any way affect the Work or those employed therein, including, but not limited to, any special acts relating to the Work or to the Project of which it is a part;

(v) it is authorized to do business in the State of Texas and properly licensed by all necessary Governmental Authorities and public and quasi-public authorities having jurisdiction over it, the Work and the Site;

(vi) the person executing this Contract on its behalf is duly authorized and empowered to do so and that all formalities necessary for its approval of this Contract have been satisfied;

(vii) it shall strictly comply with and satisfy all legal requirements applicable to the Work; and

(viii) it understands the restrictions imposed on the handling of construction payments received from the Port of Houston Authority pursuant to the State of Texas statutes and that it will fully comply with those provisions in the handling of all payments made by the Port of Houston Authority to the Contractor pursuant to this Contract.

The foregoing representations and warranties are in addition to, and not in lieu of, any and all other liability imposed upon the Contractor by law with respect to the Contractor’s duties, obligations and performance hereunder. The Contractor’s liability hereunder shall survive the Port of Houston Authority’s final acceptance of and payment for the Work. All representations and warranties set forth in this Contract, including, without limitation, this Section, shall survive the Final Completion of the Work or the
earlier termination of this Contract. The Contractor acknowledges that the Port of Houston Authority is relying on these representations and warranties in entering into this Contract with Contractor.

11.15 **Entire Agreement:**

This Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations or agreements, either written or oral.

11.16 **Severability:**

The invalidity, illegality, or unenforceability of any portion, clause or provision of this Contract, or the occurrence of any event rendering any portion, clause or provision of this Contract void, shall in no way affect the validity or enforceability of any other portion, clause or provision of this Contract. Any invalid, illegal, unenforceable or void portion, clause or provision shall be deemed severed from this Contract and the balance of this Contract shall be construed and enforced as if this Contract did not contain the particular portion, clause or provision held to be invalid, illegal, unenforceable or void. The parties further agree that, if requested by a party, the Court shall reform this Contract to replace any stricken portion, clause or provision with a valid portion, clause or provision that comes as close as possible to the intent of the stricken portion, clause or provision. This Section 11.16 shall not prevent the entire Contract from being void should a portion, clause or provision which is the essence of this Contract be determined to be invalid, illegal, unenforceable or void.

11.17 **Successors and Assigns:**

(a) The Port of Houston Authority and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect of all covenants, agreements and obligations contained in the Contract Documents.

(b) Contractor shall not assign any rights or obligations under or interest in the Contract Documents without the prior written consent of the Executive Director of the Port of Houston Authority or his designee. The Port of Houston Authority may assign its rights and obligations under and interest in the Contract Documents in whole or in part without the consent of Contractor.

11.18 **No Third Party Beneficiaries:**

The Contract Documents shall not be construed to create any contractual relationship of any kind between the Port of Houston Authority and any Subcontractor or Supplier or between any persons or entities other than the Port of Houston Authority and Contractor. Except as expressly provided herein, none of the provisions of this Contract is intended for the benefit of any other party except for the parties hereto.

11.19 **Change of Control:**

Contractor and any party which holds an equity or voting interest in Contractor shall not sell, assign, convey, encumber or otherwise transfer more than twenty-five percent (25%) of the equity or voting interest, whether it be in the form of stock, partnership interests, membership interests or other unit of ownership, in Contractor without the express prior written consent of the Port of Houston Authority.
11.20 **Governing Law:**

This Contract, its interpretation and any disputes relating to, arising out of or connected with this Contract, shall be governed by the laws of the State of Texas, without regard to its conflict of law provisions.

END OF GENERAL CONDITIONS SECTION 11

END OF GENERAL CONDITIONS
1. **Location of Site:**

   The site of the proposed work is within the Port Authority's Bayport Container Yard. Access to the site is Highway 146 onto Bayport Boulevard.

2. **Port Representatives:**

   The Port Contract Representative is the employee of the Port of Houston Authority having the title of Director, Project & Construction Management.

   The Port Construction Representative is the employee of the Port of Houston Authority having the title of Chief Construction Manager.

   The Port Authority may change the Port Contract Representative or the Port Construction Representative, and may delegate specified responsibilities of either, to another individual upon written notice to Contractor.

3. **Enumeration of Drawings:**

   The Drawings titled “**Construct Container Yard 6 North at Bayport Terminal**”, Drawing No. (C70-D01-002), with sheets being subtitled, are set forth on Drawings.

4. **Contract Price:**

   The Contract Price is set forth in the Contract and the components of it are set forth on the attached Exhibit A: Price Exhibit. The Contract Price is a “not to exceed” amount. Portions of the Work will be performed on a fixed price basis and the remainder on a Unit Cost basis. The Schedule of Costs required pursuant to General Conditions Section 10.1 shall allocate the entirety of the not to exceed Contract Price among and shall be prepared on the basis of the categories or items of Work and associated agreed upon Unit Costs and fixed prices set forth in the attached Exhibit A: Price Exhibit. Such Schedule of Costs shall, to the extent required by the Port Construction Representative, show quantities of Materials, items of machinery and Equipment, and any other items which are to be incorporated into the Work, and otherwise be in such form and detail as required by the Port Authority. Contractor shall prepare its Estimates of Contract Payment on the basis of the Schedule of Costs, the actual quantities of categories or items of Work completed in place and the associated Unit Costs for portions of Work performed on a Unit Cost basis and the percentage complete and associated fixed prices for portions of the Work performed on a fixed price basis. Any item of Work which is not specified on the accepted Schedule of Costs shall be considered incidental to related products and incorporated into the items of Work set forth on the accepted Schedule of Costs.

   Subject to such “not to exceed” Contract Price, the amount of each interim payment and the total amount due Contractor upon Final Completion shall be calculated on the basis of the sum of (i) the actual quantity of Work performed multiplied by the applicable Unit Costs for each component of the Work performed on a Unit Cost basis, and (ii) the percentage of Work complete multiplied by the applicable fixed price for each portion of the Work performed on a fixed price basis, in each instance as divided and set forth in the attached Exhibit A: Price Exhibit. Such Unit Costs and fixed prices reflect the total cost to install each such component or item completed in place. Contractor shall not be entitled to compensation: (i) in addition to the amount calculated pursuant to the first sentence of this paragraph; or (ii) in excess of the not to exceed Contract Price amount set forth in the Contract, unless and to the extent it may be amended by Change Order.
5. **Weather Days:**

Pursuant to General Conditions Section 8.11(c), the number of adverse weather days for each month is as set forth below. The Contractor shall alert the Construction Manager the first Working Day following an adverse weather event, describing the critical path activity delayed by the adverse weather event, and shall otherwise comply with the requirements of General Conditions Section 8.11 in order to be entitled to an extension of time for adverse weather. The determination of whether the Contractor is entitled to an extension of time as a result of adverse weather will be made each month for the immediately preceding month.

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<tr>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
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<td>2</td>
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<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
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</table>

6. **Water for Construction:**

Pursuant to General Conditions Section 4.20, water for construction purposes is available from the Port Authority’s fire hydrant system.

7. **Liquidated Damages:**

The entire Work shall be substantially completed within **four hundred twenty (420) working days** after Contractor’s receipt of the Port Authority’s Notice to Proceed. Contractor agrees that, should Contractor fail to substantially complete the entire Work within such **four hundred twenty (420) working days**, pursuant to General Conditions Section 6.08, the Contractor (or its surety) shall pay the Port Authority One Thousand Dollars ($1,000) for each and every CALENDAR day thereafter until Substantial Completion of the entire Work.

8. **Special Insurance Requirements:**

The Minimum Insurance Requirements of General Conditions Section 11.07 shall be amended to read as follows:

<table>
<thead>
<tr>
<th>MINIMUM INSURANCE REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kind of Insurance</strong></td>
</tr>
<tr>
<td>A. Workers’ Compensation Insurance Employers Liability Coverage</td>
</tr>
<tr>
<td>Coverage shall be endorsed as follows:</td>
</tr>
<tr>
<td>1. Longshore and Harbor Workers’ Compensation Act (If exposure exists)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>B. Commercial General Liability Coverage including but not limited to:</td>
</tr>
<tr>
<td>1. Premises and operations</td>
</tr>
<tr>
<td>2. Products and completed operations.</td>
</tr>
<tr>
<td>3. Personal and Bodily injury liability</td>
</tr>
<tr>
<td>4. Contractual Liability</td>
</tr>
</tbody>
</table>
MINIMUM INSURANCE REQUIREMENTS

<table>
<thead>
<tr>
<th>Kind of Insurance</th>
<th>Limits of Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Independent Contractors</td>
<td></td>
</tr>
<tr>
<td>6. Explosion, collapse and underground</td>
<td></td>
</tr>
<tr>
<td>7. Sudden and Accidental Pollution Liability Coverage.</td>
<td></td>
</tr>
<tr>
<td>C. Business Automobile Liability including all owned, non-owned and hired automobiles.</td>
<td>$1,000,000 Per Occurrence</td>
</tr>
<tr>
<td>D. Environmental Impairment Liability (If exposure exists)</td>
<td>$10,000,000 Per Occurrence</td>
</tr>
<tr>
<td>E. Umbrella Liability Coverage</td>
<td>$2,000,000 Per Occurrence in excess of limits of coverages in (B), (C) and (D) above.</td>
</tr>
</tbody>
</table>

9. **Measurement and Payment:**

In the “Measurement and Payment” section of the specifications, the term “lump sum” shall be interpreted to mean “fixed price”.

10. **Payment for Unincorporated Material:**

The Contractor may include in its monthly Estimates for Contract Payment requests for partial payment of the Material and Equipment, if any, set forth on Exhibit B to these Special Conditions prior to the Material or Equipment being incorporated in to the Work and, if approved in advance by the Port Contract Representative, additional approved Equipment or Material prior to it being incorporated into the Work. Prior to including a request for payment for any unincorporated Equipment or Material not listed on Exhibit B, the Contractor shall submit a request in writing to the Port Contract Representative requesting the eligibility of specific Materials, Equipment, or fabricated items proposed by the Contractor for partial payment for unincorporated materials, and obtain approval from the Port Contract Representative in writing. Requests for eligibility of Equipment or Materials may be approved or rejected by the Port Contract Representative in its sole discretion. Requests for eligibility for payment may only be made and will only be considered for items that (i) can be stored appropriately at the Site, (ii) require long lead time for manufacturing and/ or delivery, or (iii) require special fabrication for exclusive use in this Project. Items for which requests cannot be made and that will not be considered include, but are not limited to, living or perishable plant materials and otherwise perishable Material, i.e., Material that has a shelf life or whose characteristics materially change when exposed to the elements if delivered to the Site, liquid asphalt, off-site stockpiles, incidental items such as hardware, etc., Materials that have been used in the Work before the request for eligibility for payment is submitted to Port Authority, or items provided as part of mobilization.

Unincorporated Materials or Equipment for which payment is requested and that are stored on Site must be delivered and stored in an acceptable condition and remain on Port property until used or disposed of, must have been sampled, tested, approved, or certified as necessary and ready for incorporation into the Work, must not be intended to be incorporated into the Work within 30 days, and must have been paid for by the Contractor within 60 days prior to the request for payment of unincorporated Material.

Unincorporated Materials or Equipment for which payment is requested and that are stored on or off Site must be accessible to the Inspector at all times. The Port may inspect Materials and Equipment upon delivery, in storage, and at the time of installation for conformity to Contract requirements. However, it is the Contractor’s responsibility to verify that all Materials and Equipment meet Contract requirements and remove and replace at the Contractor’s expense Materials and Equipment that do not meet Contract requirements at the time of delivery and
installation. If after fabricated Materials have been approved for storage any repairs are required on the fabricated Materials, the Contractor shall make such repairs at the Contractor’s own expense after notifying and obtaining approval in writing from the Port Contract Representative. Any Material that is specially fabricated must be clearly marked and identified as being produced and reserved for exclusive use on this Project.

Requests for payment of unincorporated Equipment and Materials shall include, as part of the monthly Estimates for Contract Payment, the name of the Material, Equipment or other item, its relevance to this Project, specification or drawing reference, quantities, and proposed storage location and method. In addition, for special Equipment or Materials that require long lead times and items that require special fabrication exclusively for this Project, the Contractor shall also provide the name, address, and phone number of the manufacturer/ fabricator, and the name and phone number of the contact person employed by the manufacturer/ fabricator who is responsible for the order and delivery of the Material, Equipment or other item. The Contractor also shall attach paid material receipts to its monthly Estimates for Contract Payment evidencing payment by the Contractor for such Equipment and Materials. Materials that are fabricated are eligible for partial payment only if (i) they are completely constructed or fabricated on the Contractor’s order for this specific Project and are so marked on the manufacturers’ invoice and submitted receipt, and (ii) an approved test report has been issued and accepted by the Port Construction Representative for such Materials. Payment for precast products fabricated or constructed by the Contractor for which invoices or freight bills are not available may be made based on statements of actual cost.

Generally, payment for unincorporated Material or Equipment will be for 100% of the suppliers' invoice minus (i) retainage in accordance with the General Conditions of the Contract, and (ii) such additional amount as is necessary in the Port Authority's discretion to retain enough of the line item price in the Schedule of Costs for such Materials or Equipment to cover the remaining costs of incorporating the Material and Equipment into the Project. In no case will the amount of partial payments for unincorporated Material or Equipment exceed the supplier’s price for such Materials or Equipment or the line item price in the Schedule of Costs for the item for which the Material or Equipment is intended to be used.

Payment for Material on hand does not constitute acceptance of the Materials for final installation.

By submitting a request for payment, notwithstanding anything to the contrary in Section 10.14 of the General Conditions, the Contractor expressly authorizes the Port Authority to audit the Contractor’s records, and to perform process reviews of the record-keeping system. The Contractor shall maintain all records relating to payments for unincorporated Material or Equipment in accordance with Section 10.14 of the General Conditions and provide these records to the Port Contract Representative upon request.

If the Port Authority determines noncompliance with any of the requirements of this Section, the Port Authority may exclude payment for any or all unincorporated Material or Equipment for the duration of the Contract and, for unincorporated Material or Equipment for which payment has been made, deduct such payment from subsequent payments.

11. Payment for Mobilization and Demobilization:

Contractor’s monthly Estimates for Contract Payment for the fixed price set forth in Exhibit A: Price Exhibit for mobilization and demobilization (the “Mob/Demob fixed price”) shall be based on the percentages and amounts set forth in this Section and not based upon the percentage complete as set forth in General Conditions Section 10.2. Contractor shall include the appropriate percentage of the Mob/Demob fixed price in Contractor’s Estimate for Contract
Payment submitted for Work performed for the month in which the criteria for invoicing such percentage are satisfied. Estimates for Contract Payment which may be submitted for each percentage of the Mob/Demob fixed price are subject to the limitations set forth below.

a. Contractor may invoice for the Mob/Demob fixed price to the extent of the actual amount paid for bonds and insurance after payment by Contractor for such bonds and insurance. Contractor shall include with its Estimate for Contract Payment which includes a request for payment for bonds and insurance paid invoices reflecting payment by Contractor for payment bond, performance bond, and required insurance. Notwithstanding the actual amount paid for bonds and insurance, the portion of the Mob/Demob fixed price which may be invoiced for bonds and insurance shall not exceed the lesser of (i) ten percent (10%) of the Mob/Demob fixed price, and (ii) one percent (1%) of the Contract Price.

b. Contractor may invoice for the Mob/Demob fixed price to the extent of actual costs incurred for plant and facility setup after payment by Contractor for plant and facility setup. Contractor shall include with its Estimate for Contract Payment which includes a request for payment for plant and facility setup paid invoices and other documentation acceptable to the Port of Houston Authority reflecting the actual expenditures paid by Contractor for plant and facility setup. Notwithstanding the actual amount paid for plant and facility setup, the portion of the Mob/Demob fixed price which may be invoiced shall not exceed the lesser of (i) ten percent (10%) of the Mob/Demob fixed price and (ii) one percent (1%) of the Contract Price. The amount which may be invoiced under this paragraph is independent of the amount which may be invoiced under paragraph (a), above, for bonds and insurance.

c. Once Contractor’s approved Estimates for Contract Payment for the Adjusted Contract Price meet or exceed one percent (1%) of the Adjusted Contract Price, Contractor may include in such Estimates for Contract Payment a request for payment of up to fifty percent (50%) of the Mob/Demob fixed price; provided, however, that such requests for payment for the Mob/Demob fixed price shall not exceed five percent (5%) of the Contract Price. The portion of the Mob/Demob fixed price which may be invoiced under this paragraph includes the amounts which may be invoiced under paragraphs (a) and (b), above. The “Adjusted Contract Price” is defined as the Contract Price less the Mob/Demob fixed price.

d. Once Contractor’s approved Estimates for Contract Payment for the Adjusted Contract Price meet or exceed five percent (5%) of the Adjusted Contract Price, Contractor may include in such Estimates for Contract Payment a request for payment of up to seventy-five (75%) of the Mob/Demob fixed price; provided, however, that such requests for payment for the Mob/Demob fixed price shall not exceed ten percent (10%) of the Contract Price. The portion of the Mob/Demob fixed price which may be invoiced under this paragraph includes the amounts which may be invoiced under paragraphs (a), (b), (c) and (d), above.

e. Once Contractor’s approved Estimates for Contract Payment for the Adjusted Contract Price meet or exceed ten percent (10%) of the Adjusted Contract Price, Contractor may include in such Estimates for Contract Payment a request for payment of up to ninety (90%) of the Mob/Demob fixed price; provided, however, that such requests for payment for the Mob/Demob fixed price shall not exceed ten percent (10%) of the Contract Price. The portion of the Mob/Demob fixed price which may be invoiced under this paragraph includes the amounts which may be invoiced under paragraphs (a), (b), (c), and (d), above.
f. Contractor may include a request for payment for the remaining ten percent (10%) of the Mob/Demob fixed price in its Estimates for Contract Payment upon the latter of the following to occur: (i) complete demobilization from the Site by the Contractor, and (ii) certification by the Port Contract Representative of Substantial Completion pursuant to General Conditions Section 6.10.

Retainage will be withheld from all portions of the Mob/Demob fixed price invoiced pursuant to this Section, just as retainage is withheld from the Adjusted Contract Price. Payment of the retainage from the Mob/Demob fixed price shall be subject to the conditions for and will be made at the time of payment for retainage from Adjusted Contract Price.

12. Field Surveying:

Submittals

The Contractor shall submit to the Port Construction Representative the name, address, and telephone number of a Texas Registered Public Land Surveyor (“RPLS”) before starting the Work. The selection of a surveyor shall be subject to the approval of the Port Construction Representative. The Contractor shall also submit documentation to the Port Construction Representative verifying the accuracy of the survey work, upon request. Additionally, the Contractor shall submit a record drawing to the Managing Director, Engineering & Construction, signed by the Contractor’s RPLS that the elevations and locations of the Work are in conformance with the Contract Documents.

Survey Documentation

Contractor’s RPLS shall maintain a complete and accurate log of control and survey work as it progresses, and shall prepare a certified survey setting fourth dimensions, locations, angles and elevations of construction and site work upon completion of foundation walls and major site improvements. Copies of required documentation shall be provided to the Port Construction Representative upon completion of survey work.

Survey Reference Points

The Contractor’s RPLS shall locate and protect horizontal and vertical survey control points, identified by the Contract Documents, prior to starting the Work. Additionally, the Contractor shall preserve all permanent bench marks during construction. The Port Construction Representative shall be notified immediately of any discrepancies between survey control points identified on the plans and those identified in the field. The Port Construction Representative shall also be notified 48 hours in advance of the need for relocation of bench marks, resulting from changes in grade or other reasons.

Survey Requirements

Two permanent bench marks, referenced to established control points, shall be established by Contractor’s RPLS on site, and their locations, with horizontal and vertical data, recorded and submitted by Contractor as part of the Project record documents. Elevations, lines and levels shall also be established by Contractor’s RPLS to provide both quantities and controls for the Work. Contractor’s RPLS shall locate and periodically verify site improvements including pavements, stakes for grading, fill placement, utility locations, slopes, invert elevations, grid or axis for structures, building foundations, column locations and ground floor elevations by instrumentation and similar appropriate means.
13. Use of Premises:

Disturbance of Site

Contractor shall minimize use of Port Road with material hauling and manipulation equipment so as not to disturb normal traffic. Official Flaggers or off duty police officers are required to assist the flow of traffic when normal traffic is disturbed.

Pipeline and Utility Easements

The Contractor shall acquire all necessary permits and approvals for the use of pipeline and utility easements requiring access during the prosecution of the Work. The Contractor shall use the designated easement crossing structures, for all heavy and tracked equipment traffic on and across pipeline easements. Construction of additional easement crossings and additional vehicle or equipment traffic within easement boundaries may be conducted with the express written approval of the easement and utility owners and of the Port Contract Representative. Construction of easement crossing structures shall be at no additional cost to the Port of Houston Authority.

Utility Outages and Shutdown

The Contractor shall notify the Port of Houston and private utility companies (when applicable) a minimum of 48 hours, excluding weekends and holidays, in advance of required utility shutdown. Contractor shall coordinate all Work as required.

14. Exhibits to Special Conditions:

The following exhibits are a part of and are incorporated into these Special Conditions as if fully set forth herein:

Exhibit A: Price Exhibit

Exhibit B: Unincorporated Material

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PORT OF HOUSTON AUTHORITY

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The Technical Specifications for the above-referenced Project are the Port of Houston Authority Technical Specifications-Std listed herein and those Port of Houston Authority Technical Specifications-Std listed and amended, supplemented and otherwise modified herein.

The Port of Houston Authority Technical Specifications-Std included herein may also be found at http://www.portofhouston.com/inside-the-port-authority/purchasing/engineering-specs-and-standards/ or an electronic copy may be obtained from the Port of Houston Authority Engineering Department.

Any Port of Houston Authority Technical Specifications-Std specification Section which is listed herein but not amended, supplemented or otherwise modified herein shall apply as set forth in the Port of Houston Authority Technical Specifications-Std.

Amendments and other modifications to a specific Section of the Port of Houston Authority Technical Specifications-Std take precedence over such Specification Section language of the Port of Houston Authority Technical Specifications-Std.

Any newly added Technical Specification Sections are in addition to the Port of Houston Authority Technical Specifications-Std.

Subject to the foregoing, the Port of Houston Authority Technical Specifications for the above-referenced Project are as follows.
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

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PART 1 GENERAL

1.1 SECTION INCLUDES
Subject to the General and Special Conditions, this section includes the requirements for implementing the MOSS Internet/Web-based project management software.

1.2 RELATED SECTIONS
A. All Contract Documents, including General Conditions, Special Conditions, and other Division 01 - General Requirements, apply to the work of this section.
B. This section contains general information that applies to all work performed under the Contract, and is made inherently a part of each specification section.

1.3 REFERENCES
(Not Applicable)

1.4 MEASUREMENT AND PAYMENT
Subject to Section III, no separate payment shall be made for the MOSS Internet/Web-based project management software licenses. The Contractor is required to have two licenses.

1.5 SUBMITTALS
A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.6 GENERAL PROJECT MANAGEMENT OBJECTIVES
A. The Port of Houston Authority has directed its Port Construction Representative to use MOSS Internet/Web-based project management software to track and manage the project.
B. Use of this project management software will not replace or change any contractual responsibilities of the construction team members.

Each project team member of the Contractor: Superintendent, Project Engineer, Scheduler, and Project Manager shall have access to the Internet and an Internet e-mail address in order to communicate with various project team members. The Contractor shall provide immediately upon receipt of the Purchase Order Date confirmation of these conditions and the names, positions, and e-mail addresses to the Port Construction Representative.

1.7 SOFTWARE AND HARDWARE REQUIREMENTS
A. The Contractor is required to purchase any hardware and software that may be required to access the MOSS system via the Internet. The Port of Houston Authority shall provide the required number of temporary licenses to use the project database for the duration of the project. Contractor's licenses to the Port of Houston Authority's MOSS database will permit access only to this project, in accordance with permission levels configured by the
Port of Houston Authority’s MOSS Administrator. The Contractor shall contract directly with MOSS for training (if required).

B. The MOSS Administrator for this project is the Port Construction Representative, or his designated representative.

C. The Contractor shall provide an adequate number of users to properly manage the project in accordance with the Project Schedule. The Contractor shall have Internet access through an Internet service provider of his/her choice.

D. Software requirements are as follows:
   1. A 32-bit operating system such as Windows 2000 or Windows NT.
   2. An Internet Browser that supports HTML 1.1, Tables, Cookies, JavaScript, and Frames. Internet Explorer version 5.0 (not Netscape).

E. Hardware requirements are as follows:
   1. Pentium based (or equivalent) workstation or laptop.
   2. A high-speed connection to the Internet, as defined in the communications section (128k baud is the minimum operating speed).

1.8 SYSTEM MANAGEMENT AND USE

A. The Port Construction Representative, or his designated representative, will administer the MOSS user accounts.

B. All costs associated with the Contractor’s use of this system, including computer hardware, Internet service, temporary licenses and training to use the project database are the responsibility of the Contractor.

1.9 USE BY SUBCONTRACTORS

A. The Port of Houston Authority encourages but does not require the Contractor to utilize MOSS project management software for communicating with his/her Subcontractors. The Contractor shall inform all Subcontractors of the purpose of the project management system and how it can assist them in obtaining information for the project.

1.10 COMMUNICATION PROCESS

A. Most project communication will take place in the MOSS project management system by creating and distributing documents directly within the system, or by entering manually in the system dates and descriptions of items to track over time. All documents requiring formal signatures will be printed, and their hard copies signed and distributed.

B. The Contractor will enter and maintain the official Submittal Log in MOSS, but will distribute prints, documents, reports, samples, etc. in the traditional manner, outside the system. The MOSS project management system will be used to track and expedite processing of these items.

C. Contractor Daily Reports, Meeting Minutes, Punch Lists, and Requests for Information (RFI) will be entered into the MOSS project management system. The Contractor can enter a RFI and the Design Consultant respond to the RFI completely within the MOSS project management system without creating a hard copy. Support documentation in hard copy format for any document in MOSS may be scanned into an electronic file and attached in MOSS to the document.
D. The Contractor is required to use a digital camera in order to photo-document job progress and upload the associated images taken on a regular basis to the Internet site. A daily progress photo should accompany each daily report submitted by the Contractor. Cost for digital camera to be incurred by Contractor. The Port Construction Representative can offer assistance to the Contractor for the selection of a digital camera, if Contractor does not presently own one.

E. The communications above do not comprise an inclusive list, and required communications are subject to change. The Port Construction Representative will provide a specific project communications list.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION
PORT OF HOUSTON AUTHORITY

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SECTION 01 33 32.00 Add - CONSTRUCTION PHOTOS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to General and Special Conditions, this Section includes the requirements taking and submitting Construction photographs by the Contractor.

B. The Purpose of the photographs is to document progress being made each week and to document problems encountered.

1.2 RELATED SECTIONS

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

(Not Applicable)

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this section.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.6 TAKING PHOTOGRAPHS

A. Content:

1. Take photos of buildings and structures as they progress.

2. Take photos of underground construction operations. Include photos of piping and casings being installed. Also, include photos of bedding and select material being used.

3. Take photos of roads and fencing as they are constructed.

4. Prior to placing concrete, take photos inside and outside of forms. Also, take photos of rebar, piping being embedded in concrete, and vapor barriers.

5. Take photos of problems being encountered.

B. Use a digital camera with at least 7 mega pixels resolution.

C. On average take at least 5 photos each day on which work is in progress.

D. Take photos only when light conditions are good.
E. Do not take duplicate photos of the same thing in order to meet the quota in the preceding sentence. Instead reserve your photos for use on days where there are several activities.

1.7 PROCESSING AND SUBMITTING PHOTOGRAPHS

A. Show the Port Authority’s project number, date and subject in each photo.

B. Reduce resolution of photos to reduce file sizes, but make it good enough to produce a clear image on a computer screen.

C. Complete the processing of photos within one work week after the week in which the photos were taken.

D. On Mondays, one calendar week after a set of photos is taken; submit electronic copies of photos to Port Construction Representative’s FTP project photo site via email. Put Port Authority’s project number on photo folder.

E. If there was no activity for a given week, send an email to the Port Construction Representative to make him aware of that.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION
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SECTION 01 45 00.00 Add - TESTING LABORATORY SERVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the requirements for testing laboratory services.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this section.

1.4 PERFORMANCE REQUIREMENTS

A. OWNER will employ an independent testing laboratory to perform testing for work specified in following sections:

1. 02 30 00.00 – Building Pad, Dug Foundations, and Footings
2. 03 30 00.00 – Concrete Construction
3. 10 46 50.00 – Drilled Shaft Foundations
4. 31 23 13.00 – Excavation and Grading for Paved Areas and Railroads
5. 31 23 34.00 – Structural Excavation, Fill, and Backfill
6. 31 23 35.00 – Excavation and Backfill for Utilities
7. 32 13 13.01 - Roller Compacted Concrete

B. Employment of laboratory shall, in no way, relieve CONTRACTOR of obligations to perform work.

1.5 REFERENCES

A. American Society for Testing and Materials (ASTM):


1.6 QUALIFICATIONS OF LABORATORY

A. Meet basic requirements of ASTM E329.
B. Authorized to operate in state in which Project is located.

C. Testing Equipment

1. Calibrated at reasonable intervals by devices of accuracy traceable to either:
   a. National Bureau of Standards;
   b. Accepted values of natural physical constants.

1.7 LABORATORY DUTIES

A. Cooperate with PORT CONSTRUCTION REPRESENTATIVE and CONTRACTOR; provide qualified personnel to perform Work after due Notice to Proceed.

B. Perform specified inspections, secure samples, and test materials.

1. Comply with specified standards.

C. Promptly notify CONTRACTOR and PORT CONSTRUCTION REPRESENTATIVE of observed irregularities or deficiencies of Work, equipment or material.

D. Promptly submit written report of each test and inspection; one copy each to PORT CONSTRUCTION REPRESENTATIVE, material supplier, and CONTRACTOR, and one copy to record document file. Each report shall include following:

1. Date issued;
2. Project title and number;
3. Testing laboratory name, address, and telephone number;
4. Name and signature of laboratory inspector;
5. Date and time of sampling or inspection;
6. Record of temperature and weather conditions if test performed in field;
7. Date of test;
8. Identification of product and Specification section;
9. Location of sample or test in Project;
10. Type of inspection or test;
11. Results of tests and compliance with Contract Documents;
12. Interpretation of test results, when requested by PORT CONSTRUCTION REPRESENTATIVE.

E. Perform additional tests as required by the Port Authority.

1.8 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Cooperate with laboratory personnel and provide access to Work.

B. Provide to laboratory preliminary design mix proposed to be used for concrete and other material mixes which require control by testing laboratory.

C. Furnish copies of product test reports.

D. Furnish incidental labor and facilities.

1. Provide access to Work to be tested.
2. Obtain and handle samples at Project site or at source of product to be tested.
3. Facilitate inspections and tests.
4. Store and cure test samples.

E. Notify laboratory and PORT CONSTRUCTION REPRESENTATIVE sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
   1. When tests or inspections cannot be performed after such notice, reimburse PORT CONSTRUCTION REPRESENTATIVE for laboratory personnel and travel expenses incurred due to CONTRACTOR'S negligence.

F. Make arrangements with laboratory and pay for additional samples and tests required for CONTRACTOR'S convenience.

G. Pay for services of testing laboratory to perform additional inspections, sampling, and testing required when initial tests indicate Work does not comply with Contract Documents.

PART 2  PRODUCTS  (Not Used)

PART 3  EXECUTION  (Not Used)

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 01 50 00.00 Add - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes temporary facilities and the necessary controls for the project including utilities, telephone, sanitary facilities, field office, storage sheds and building, safety requirements, first aid equipment, fire protection, security measures, protection of the Work and property, access roads and parking, environmental controls, disposal of trash, debris, and excavated material, pest and rodent control, water runoff and erosion control.

B. The facilities and controls specified in this section are considered minimum for the Project. The Contractor may provide additional facilities and controls for the proper execution of the Work and to meet Contractor’s responsibilities for protection of persons and property.

C. Prior to beginning construction activities that will disturb the existing condition of the site, the Contractor is to perform a topographic survey of the existing site for use in determining earthwork needs and as verification of existing surface profile and condition. Survey is to encompass project limits, identifying high points, low points and grade breaks within a grid spacing of no more than 100 feet each side and shall be of sufficient detail to use as a basis for earthwork quantity payments. Survey to be performed by the registered public land surveyor (RPLS), licensed in the State of Texas. Contractor is to provide results of survey, (CADD file and paper drawing) to Port Construction Representative with his first pay application.

1.2 RELATED SECTIONS

A. 31 41 33.01 and 31 41 33.02 - Trench Safety System

B. 01 56 39.00 - Tree and Plant Protection

The requirements of Division 01 and general and special conditions of this contract apply to this work.

1.3 REFERENCES

[None]

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, items inclusive of the requirements of this section are to be included in the price for item “Mobilization and Demobilization”. “Mobilization and Demobilization” will be paid for on a lump sum basis. Price is to include items herein, considerate of initiating the project as well as demobilization upon the completion of the project, EXCEPT Initial Land Survey shall be paid for as described below.

B. Initial Land Survey by RPLS prior to construction activities will be paid for at the Lump Sum price for the survey. Requirements of the land survey are as described above in section 1.1C.
C. Partial payment of the lump sum bid for “Mobilization and Demobilization” will be made as follows. The adjusted contract amount for construction items as used below is defined as the original total contract award amount less the lump sum bid for “Mobilization and Demobilization”.
   
a. When 1 percent of the contract amount for construction items is earned, 50 percent of the “Mobilization and Demobilization” lump sum or 5 percent of the total contract amount, whichever is less, will be paid for this item.
   
b. When 5 percent of the contract amount for construction items is earned, 75 percent of the “Mobilization and Demobilization” lump sum or 10 percent of the total contract amount, whichever is less, will be paid for this item. Previous payment under this item will be deducted from the above amount.
   
c. When 10 percent of the contract amount for construction items is earned, 90 percent of the “Mobilization and Demobilization” lump sum bid or 15 percent of the total contract amount whichever is less, will be paid for this item. Previous payment under this item will be deducted from the above amount.
   
d. Upon completion of all work under this contract, payment for the remainder of the lump sum bid for “Mobilization and Demobilization” will be made.

1.5 SUBMITTALS
Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.6 CONTRACTOR’S RESPONSIBILITY
Contractor shall comply with the requirements of this Section and applicable requirements in other sections of these specifications, which include but are not limited to:

1. Maintain and operate temporary facilities and systems to assure continuous service.
2. Modify and extend systems as Work progress requires.
3. Completely remove temporary materials and equipment when their use is no longer required.
4. Restore existing facilities used for temporary services to specified or to original condition.

1.7 TEMPORARY UTILITIES
A. Obtaining Temporary Service:
   
   1. Make arrangements with utility service companies for temporary services.
   
   2. Abide by rules and regulations of the utility service companies or authorities having jurisdiction.
   
   3. Be responsible for utility service costs until the Work is substantially complete. Included are fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of the Work.

B. Water:
   
   1. Provide water required for and in connection with Work to be performed and for specified tests of piping, equipment, devices, or for other use as required for proper completion of the Work.
   
   2. Provide and maintain an adequate supply of potable water for domestic consumption by Contractor personnel and Port Construction Representative or his Representatives.
C. Electricity and Lighting:
1. Provide electric powered service as required for the Work, including testing of Work. Provide power for lighting, operation of the Contractor’s equipment, or for any other use by Contractor.
2. Electric power service includes temporary power service or generator to maintain plant operations during any scheduled shutdown.
3. Minimum lighting level shall be 5 foot-candles for open areas; 10-foot-candles for stairs and shops. Provide a minimum of one 300-watt lamp for each 20 square feet in work area.

D. Temporary Heat and Ventilation:
1. Provide temporary heat as necessary for protection or completion of the Work.
2. Provide temporary heat and ventilation to assure safe working conditions; maintain enclosed areas at a minimum of 50 degrees F.

E. Telephone:
1. Provide emergency telephone service at the Contractor’s office for use by Contractor personnel and others performing work or furnishing services at the site.
2. Provide a separate phone line and instrument in the field office, if used, for the Port Construction Representative and the Inspector. Cost for local calls and other project-related calls made by the Inspector shall be paid for by the Contractor.

F. Sanitary Facilities:
1. Provide and maintain sanitary facilities for persons on the job site; comply with the regulations of State and local departments of health.
2. Enforce the use of sanitary facilities by construction personnel at the job site. Such facilities shall be enclosed. Pit-type toilets will not be permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as not to cause a nuisance or health problem; have sewer and waste hauled off-site and properly disposed.
3. Locate toilets near the Work site and secluded from view insofar as possible. Keep toilets clean and supplied throughout the course of the Work.

1.8 FIELD OFFICE
A. Furnish and Locate:
1. Furnish, locate, install and maintain a field office approximately 12’ x 56’ for the exclusive use of the PORT AUTHORITY. Provide sufficient room for project meetings and office for the PHA Construction Representative. Locate the office in a place approved by the PHA Construction Representative.
2. Provide office space ready for occupancy, 10 days after date fixed in Notice to Proceed.
3. Construct all-weather, hard surfaced parking spaces, suitable for weather and duration of Project, for use by the PHA Construction Representative and/or his designated representative. Provide an all-weather surfaced walk between the parking spaces and the office.
4. 3.1 Cu.Ft. Energy Star Refrigerator/Freezer (to become PHA property)
5. 1100W Microwave (to become PHA property)

B. Minimum Construction:
1. Structurally sound foundation and superstructure.
2. Completely weather tight with insulated roof and walls.
3. Stairs or walkway with handrail and entrance platform (10’ x 20’) with a mud scraper at door.
4. Resilient floor covering.
5. Screened windows with an area equal to approximately 10 percent of floor area sufficient for light, view, and ventilation. Provide windows with operable sash.
6. Secure, lockable exterior doors with dead bolt cylinder locks.

C. Minimum Services:
1. Exterior light at entrance.
2. Interior lighting of 50 foot-candles at desk top height.
3. Automatic heating to maintain 65 degrees F in winter.
4. Automatic cooling to maintain 75 degrees F in summer.
5. Electric power service.
6. Four electric wall outlets.
7. Separate telephone service.
8. Chilled drinking water.
9. Separate sanitary facilities with one water closet and one lavatory and medicine cabinet.
10. Plumbing and sewers as required, protected from freezing.
11. Alarm system hooked to Police and/or a Security Response Service.
12. Contractor will be responsible for installing all utilities and services to the office trailer.
13. Trailer to be tied down.

D. Minimum Furnishings:
1. Three 5-drawer desks.
2. Three swivel desk chairs.
3. Two 4-drawer legal file cabinets.
4. Bunn coffee pot and supplies.
5. Six 5’ bookcases.
6. Four waste baskets.
7. One tack board 30 inches by 36 inches.
8. Three dry erase boards 3’x5’ min. size
9. Fire extinguishers.
10. Identifying exterior sign (4’x8’) acceptable with port logo and address.
11. Projector and drop down screen. (will become PHA property).
12. First aid kit.
13. Eye Wash Station
14. Six protective helmets (hard hats) for use by the Port Construction Representative and visitors.
15. Conference table and chairs to accommodate 15 persons
16. Leased Xerox color copier with fax, scanning, and printing capabilities. Contractor to provide toners and maintenance.
17. Bottled water dispenser and a regular supply of water.
18. Other furnishings at Contractor’s option.

E. Maintenance:
1. Schedule continuous maintenance of office, walkways, and services; cleaned not less than once per week;
2. Provide soap, paper towels, cleansers, janitorial service and appurtenances;
3. Immediately repair any damage, leaks or defective service.
4. Mow / weed vegetation bi-weekly (spring/summer) or monthly (fall/winter) to remove potential fire hazard.

F. Utilities and Services
1. Provide Trash Pickup.
2. Provide Electrical Service.
3. Provide Water and Sewer Service.
4. Phone and Internet Service.

G. Provide adequate space for one set of Contract Documents in the office for ready reference.

H. Typical Floor Plan:

![Floor Plan Diagram]

1.9 SAFETY REQUIREMENTS

A. Submit and follow a safety program in accordance with General Conditions. Include in the safety program documented response to trench safety requirements as specified in Section 31 41 33.00 - Trench Safety System.

B. Conduct operations in strict accord with applicable Federal, State and local safety codes and statutes and with good construction practice. The Contractor is fully responsible and obligated to establish and maintain procedures for safety of all work, personnel and equipment involved in the Project.

C. Observe and comply with all applicable laws governing health and safety including without limitation the Texas Workers Health and Safety Act (Ch. 411 of the Texas Labor Code) and with all safety and health standards promulgated by Secretary of Labor under Section 107 of Contract Work Hours and Standards Act, published in 29 CFR Part 1926 and adopted by Secretary of Labor as occupational safety and health standards under the Williams-Steiger Occupational Safety and Health Act of 1970, and to any other legislation enacted for safety and health of Contractor employees. Such safety and health standards apply to subcontractors and their employees as well as to the Contractor and its employees.

D. Observance of and compliance with the regulations shall be solely and without qualification the responsibility of the Contractor without reliance or superintendence of or direction by the Port of Houston Authority or any Port of Houston Authority representative. Immediately advise the Port Construction Representative of investigation or inspection by Federal Safety and Health inspectors of the Contractor or subcontractor’s work or place of work on the job site under this Contract, and after such investigation or inspection, advise the Port Construction Representative of the results. Submit one copy of accident reports to Port Construction Representative within 10 days of occurrence.

E. Protect areas occupied by workmen using the best available devices for detection of lethal and combustible gases. Test such devices frequently to assure their functional capability. Constantly observe the Work area for visual or odor evidences of contamination, immediate take appropriate steps to seal off entry of contaminated liquids to the Work area.
F. Safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment and safety equipment, are obligations of the Contractor, as defined in the General Conditions.

1.10 FIRST AID EQUIPMENT
A. Provide a first aid kit throughout the construction period. List telephone numbers for physicians, hospitals, and ambulance services in each first aid kit. Such facilities and services are to be local to the job site.
B. Have at least one person thoroughly trained in first aid procedures present on the site whenever Work is in progress.
C. Provide emergency eye wash station at the Field Office.

1.11 FIRE PROTECTION
Conform to specified fire protection and prevention requirements established by Federal, State, or local governmental agencies and as provided in Contractor's Safety Program.

1.12 SECURITY MEASURES
A. Protect all Work materials, equipment, and property from loss, theft, damage, and vandalism. Contractor's duty to protect property includes the Port of Houston Authority's property and property used in connection with the performance of the Contract.
B. If existing fencing or barriers are breached or removed for purposes of construction. Provide and maintain temporary security fencing equal to existing.

1.13 PROTECTION OF PUBLIC UTILITIES
Prevent damage to existing public utilities during construction. These utilities are shown on the Drawings at their approximate locations. The Contractor is responsible for verifying the location of all utility lines prior to the start of the Work, and for identifying and protecting any utilities not shown on the Drawings. Give owners of these utilities at least 5 working days notice before commencing Work in the area, for locating the utilities during construction, and for making adjustments or relocation of the utilities when they conflict with the proposed Work. The Contractor shall incur the cost of any damages to utilities resulting from construction activities.

1.14 PROTECTION OF THE WORK AND PROPERTY
A. Preventive Actions:
1. Take precautions, provide programs, and take actions necessary to protect the Work and public and private property from damage.
2. Take action to prevent damage, injury or loss, including, but not be limited to, the following:
   a. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with progress of the Work or the Work of any other contractor, any utility service company, or the Port of Houston Authority's operations.
   b. Provide suitable storage for materials which are subject to damage by exposure to weather, theft, breakage, or otherwise.
   c. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
   d. Frequently clean up refuse, rubbish, scrap materials, and debris caused by construction operations, keeping the Project site safe and orderly.
   e. Provide safe barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways, and other hazardous areas.
3. Notify the Port Construction Representative and provide Port Construction Representative copies of written consent from proper parties before entering or
occupying with workers, tools, materials or equipment, privately-owned land except on easements provided for construction.

4. Assume full responsibility for the preservation of public and private property on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect, or misconduct in execution of the Work by the Contractor, it shall be restored by the Contractor to a condition equal to or better than that existing before the damage was done.

B. Barricades and Warning Signals: Where Work is performed on or adjacent to any roadway, right-of-way, or public place, furnish and erect barricades, fences, lights, warning signs, and danger signals; provide watchmen; and take other precautionary measures for the protection of persons or property and protection of the Work. Use barricades painted to be visible at night. From sunset to sunrise, furnish and maintain at least one light at each barricade. Erect sufficient barricades to keep vehicles from being driven on or into Work under construction. Furnish watchmen in sufficient numbers to protect the Work. Maintain barricades, signs, and lights, and provide watchmen until the Project is accepted by the Port of Houston Authority.

C. Tree and Plant Protection: Preserve and protect existing trees and plants to remain from foliage, branch, trunk or root damage that could result from construction operations.

   1. Prevent the following types of damage:
      a. Compaction of root zone by foot or vehicular traffic, or material storage.
      b. Trunk damage from equipment operations, material storage, or from nailing or bolting.
      c. Trunk and branch damage caused by ropes or guy wires.
      d. Root poisoning from spilled solvents, gasoline, paint and other noxious materials.
      e. Branch damage due to improper pruning or trimming.
      f. Damaged from lack of water due to: Cutting or altering natural water migration patterns near root zones.

D. Protection of Existing Structures:

   1. Underground Structures:
      a. Underground structures are defined to include, but not be limited to, sewer, water, gas, and other piping, and manholes, chambers, electrical and signal conduits, tunnels, and other existing subsurface installations located within or adjacent to the limits of the Work.
      b. Known underground structures, including water, sewer, electric, and telephone service connections are shown on the Drawings. This information is shown for the assistance of the Contractor in accordance with the best information available, but is not guaranteed to be correct or complete.
      c. Explore ahead of trenching and excavation work and uncover obstructing underground structures sufficiently to determine their location, to prevent damage to them and to prevent interruption of utility services. Restore to original condition damages to underground structure at no additional cost to the Port of Houston Authority.
      d. Necessary changes in location of the Work may be made by the Port Construction Representative to avoid unanticipated underground structures.
      e. If permanent relocation of an underground structure or other subsurface installations is required and not otherwise provided for in the Contract Documents, the Port Construction Representative will direct Contractor in writing to perform the Work, which shall be paid for under the
provisions for changes in the Contract Price as described in the General Conditions.

2. Surface Structures:

Surface structures are defined as existing buildings, structures and other constructed installations above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks, guard cables, fencing, and other facilities that are visible above the ground surface.

3. Protection of Underground and Surface Structures:

a. Support in place and protect from direct or indirect injury underground and surface structures located within or adjacent to the limits of the Work.

b. Before installing structure supports, the Contractor shall satisfy the Port Construction Representative that the methods and procedures to be used have been approved by the owner of the structure. Avoid moving or in any way changing the property of public utilities or private service corporations without prior written consent of a responsible official of that service or public utility. Representatives of these utilities reserve the right to enter within the limits of this project for the purpose of maintaining their properties, or of making such changes or repairs to their property that may be considered necessary by performance of this Contract.

c. Notify the owners and/or operators of utilities and pipelines of the nature of construction operations to be performed and the date or dates on which those operations will be performed. When construction operations are required in the immediate vicinity of existing structures, pipelines, or utilities, give a minimum of 5 working days advance notice. Probe and flag the location of underground utilities prior to commencement of excavation. Keep flags in place until construction operation reach and uncover the utility.

d. The Contractor shall assume the risks attending the presence or proximity of underground and surface structures within or adjacent to the limits to the Work including but not limited to damage and expense for direct or indirect injury caused by his Work to any structure. Immediately repair damage caused, to the satisfaction of the owner of the damaged structure.

E. Protection of Installed Products:

1. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.

2. Control traffic to prevent damage to equipment, materials, and surfaces.

3. Provide coverings to protect equipment and materials from damage. Cover projections, wall corners, jambs, sills, and exposed sides of openings in areas used for traffic and for passage of materials in subsequent work.
1.15 ROADS AND PARKING
A. Designate temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by the Port Construction Representative.
B. Minimize use by construction traffic of existing streets and driveways.
C. Do not allow heavy vehicles or construction equipment in existing parking areas.

1.16 ENVIRONMENTAL CONTROLS
A. Provide and maintain methods, equipment, and temporary construction as necessary for controls over environmental conditions for the prevention of environmental pollution and preservation of natural resources at the construction site and adjacent areas.
B. Comply with statutes, regulations, and ordinances which relate to the proposed Work for the prevention of environmental pollution and preservation of natural resources, including but not limited to the National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.
C. The Port of Houston Authority recognizes that the site has considerable natural value and that construction of projects should have minimum impact to the surrounding environment. The Contractor shall adopt construction procedures that do not cause unnecessary excavation and filling of the terrain, indiscriminate destruction of vegetation, air or stream pollution, nor the harassment or destruction of wildlife.
D. Recognize and adhere to the environmental requirements of the Project. Disturbed areas shall be strictly limited to boundaries established by the Contract Documents. Particularly avoid pollution of "on-site" streams, sewers, wells, or other water sources.
E. Burning of rubbish, debris or waste materials is not permitted.
F. The Port of Houston Authority has developed an Environmental Management System (EMS). As part of the EMS, the Port of Houston Authority has adopted an environmental compliance policy and has developed environmental management programs. Contractor shall adhere to such policy and programs and provide information to the Port of Houston Authority in the form and at the times requested by the Port of Houston Authority in furtherance of such policy and programs.

1.17 POLLUTION CONTROL
A. Provide methods, means, and facilities required to prevent contamination of soil, water or atmosphere by discharge of noxious substances from construction operations.
B. Provide equipment and personnel to perform emergency measures required to contain any spillage, and to remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.
C. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
D. Provide systems for control of atmospheric pollutants.
   1. Prevent toxic concentrations of chemicals.
   2. Prevent harmful dispersal of pollutants into the atmosphere.
E. Use equipment during construction that conforms to current Federal, State, and local laws and regulations.
F. Contractor shall develop a spill plan and follow Good Housekeeping Practices outlined in the Project Storm Water Pollution Prevention Plan.

G. Contractor shall place any possible pollutants in containment berm to prevent contaminated runoff.

H. Contractor shall have Material Safety Data Sheets (MSDS) on site for all materials.

1.18 PEST AND RODENT CONTROL
A. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.
B. Employ methods and use materials that will not adversely affect conditions at the site or on adjoining properties.

1.19 NOISE CONTROL
A. Provide vehicles, equipment, and construction activities that minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and local ordinances. Noise levels will not be permitted which interfere with the operations of the Port of Houston Authority or create a nuisance in the surrounding residential neighborhoods.
B. Conduct construction operations during daylight hours except as approved by the Port Construction Representative.
C. Select construction equipment to operate with minimum noise and vibration. If in the opinion of the Port Construction Representative, objectionable noise or vibration is produced by equipment, rectify such conditions without additional cost to the Port of Houston Authority. The Sound Power Level (PWL) of any equipment shall not exceed 85 dbA (re: 10^{-12} watts) measured 5 feet from the piece of equipment, or the levels prescribed by local ordinances, whichever is lower.

1.20 DUST CONTROL
A. Control objectionable dust caused by operation of vehicles and equipment. Apply water or use other methods, subject to approval through the submittal process, which will control the amount of dust generated.
B. Contractor will submit for approval a dust control plan which will include measures to control dust from traffic on access roads, material stockpile areas, and other areas of construction, and with special emphasis during periods of limited rainfall or higher than average wind.
C. Contractor will minimize disturbance of land areas beyond construction limits. Contractor is responsible for control of fugitive dust in disturbed areas, beyond actual construction limits, for which Contractor has permission to work in or travel through.

1.21 WATER RUNOFF AND EROSION CONTROL
A. Where required, the Contractor shall comply with the Port of Houston Authority Municipal Separate Storm Sewer Systems (MS4) Permit Program and the Texas Pollutant Discharge Elimination System (TPDES) permit as stated in the Federal Regulations, 40 CFR, Part 122.
B. In addition, the Contractor shall comply with the following:
   1. Provide methods to control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.
2. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, sedimentation or damage.

3. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

4. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas and in conformance with environmental requirements.

5. Retain existing drainage patterns external to the construction site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as needed to control conditions.

6. Plan and execute construction and earth-work by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
   a. Keep to a minimum the area of bare soil exposed at one time.
   b. Provide temporary control measures, such as berms, dikes, and drains.

7. Construct fills and waste areas by selective placement to eliminate surface silts or clays, which will erode.

8. Inspect earthwork periodically to detect any evidence of the start of erosion. Apply corrective measures as required to control erosion.

PART 2 PRODUCTS  (Not Used)

PART 3 EXECUTION  (Not Used)

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 01 57 13.01 Add - TEMPORARY REINFORCED FILTER FABRIC BARRIER

PART 1    GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the installation of Reinforced Filter Fabric Barrier as an erosion and sedimentation control which shall be utilized, as part of the Storm Water Pollution Prevention Plan (SWPPP), during construction and prior to the final development of the site.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Manufacturers’ catalog sheets and other pertinent information on geotextile fabrics.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for Reinforced Filter Fabric Barrier. Include cost for item as part of Temporary Storm Water Controls Section 01 57 23.00.

PART 2    PRODUCTS

2.1 FILTER FABRIC

A. Provide woven or nonwoven geo-textile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

1. Geotextile fabric shall have a minimum grab strength of 100 psi in any principal direction (ASTM D4632).


3. Equivalent opening size between 50 and 140 for soils with more than 15 percent by weight passing a No. 200 sieve and between 20 and 50 for soils with less than 15 percent by weight passing a No. 200 sieve.

4. Maximum water flow rate of 40 gallons per minute per square feet (ASTM D4491).

5. Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.

B. Acceptable Manufacturers:

1. Marifi, Inc.

2. Or approved substitution.

PART 3    EXECUTION

3.1 GENERAL

A. Provide erosion and sedimentation control systems at the locations shown in the Drawings. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and set out in this Section of
the specifications. Reinforced filter fabric barrier design shall be based on guidelines provided in the *Storm Water Management Handbook for Construction Activities* (2006 Edition), prepared by the Storm Water Management Joint Task Force, or other industry-standard document approved by the Port Construction Representative. Refer to the excerpt from the aforementioned document attached at the end of this Section for details related to reinforced filter fabric barrier design.

B. No clearing and grubbing or rough cutting, other than as specifically directed by the Port Construction Representative, to allow soil testing and surveying, shall be permitted until erosion and sedimentation control systems are in place.

C. Install and maintain erosion and sedimentation control systems located within the project site prior to the start of construction under this Contract until final site stabilization or until approval is received from the Port Construction Representative to remove and discard the existing system.

D. Inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until final site stabilization. Remove erosion and sedimentation control systems promptly upon approval of the Port Construction Representative. Discard removed materials offsite.

E. All sediment generated during construction will remain on the Project site. Sediment should be spread, compacted and stabilized in accordance with the Port of Houston Authority Municipal Separate Storm Sewer System (MS4) Permit Program. Sediment shall not be allowed to flush into stream or drainage way. If any contaminated sediment is encountered, the Contractor shall notify the Port of Houston Authority Environmental Affairs Manager.

F. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soils in a maximum of 8-inch layers. Compaction density shall be at a minimum of 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.

G. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

H. Conduct all construction operations under this Contract in conformance with the erosion control practices described in the Project SWPPP.

3.2 CONSTRUCTION METHODS

A. Provide reinforced filter fabric barrier systems at locations specified on the Drawings. Reinforced filter fabric barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire support to 2-inch by 2-inch wooden posts or steel fence posts (minimum of 1.25 lbs. per linear foot and Brinell hardness greater than 140) spaced 3 feet apart and embedded a minimum of 1 foot. Maximum spacing of 8 feet is allowed if posts are made of hot rolled steel, at least 4 feet long with Tee or Y-bar sections with the surface painted or galvanized. Provide safety caps on top of metal posts. The steel posts shall be installed at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow as shown on the attached drawings. Trench shall be a minimum of 6-inch by 6-inch. Lay filter fabric along the edges of the trench. Backfill and compact trench.

D. Woven wire shall be galvanized 2" x 4" welded wire fabric, 12-1/2 gauge. Securely fasten the filter fabric material to the woven wire with tie wires.
E. The filter fabric should be provided in continuous rolls and cut to the length of the silt fence to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6-inch overlap, and sealed securely.

F. When used in swales, ditches, or diversions, the elevation of the barrier at the top of the filter fabric at the flow line location in the channel shall be lower than the bottom elevation of the filter fabric at the ends of the barrier or the top of bank, whichever is less, in order to keep storm water discharge in the channel from overtopping the bank.

G. Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this specification. Remove sediment deposits when silt reaches one-third of the height of the barrier in depth.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 01 57 14.00 Add – STABILIZED CONSTRUCTION ENTRANCE

PART 1    GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the installation of Stabilized Construction Entrance as an erosion and sedimentation control which shall be utilized, as part of the Storm Water Pollution Prevention Plan (SWPPP), during construction and prior to the final development of the site.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit manufacturer’s catalog sheets and other product data on geotextile fabric.

C. Submit sieve analysis of aggregates conforming to requirements of this Section of the specifications.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for Stabilized construction roads, parking areas, exits and truck-washing areas. Include cost for item as part of Temporary Storm Water Controls Section 01 57 23.00. Price shall include providing and installation of geotextile fabric, aggregate placed in 8-inch layers, and maintenance and all other items as needed to adhere to the requirements of the SWPPP. No separate payment will be made for street cleaning necessary to meet TPDES requirements.

PART 2    PRODUCTS

2.1 GEOTEXTILE FABRIC

A. Provide woven or nonwoven geo-textile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

1. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D4632).

2. Equivalent opening size between 50 and 140.

3. The geotextile shall be resistant to chemical attack, mildew, and rot and contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
B. Acceptable Manufacturers:

1. Marifi, Inc.
2. Or approved substitution.

2.2 COARSE AGGREGATES

A. Coarse aggregate: Crushed stone, gravel, crushed blast furnace slag, or combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings of, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to following gradation requirements.

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PART 3 EXECUTION

3.1 GENERAL

A. Provide erosion and sedimentation control systems at the locations shown in the Drawings. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and set out in this Section of the specifications. Stabilized Construction Entrance design shall be based on guidelines provided in the *Storm Water Management Handbook for Construction Activities* (2006 Edition), prepared by the Storm Water Management Joint Task Force, or other industry-standard document approved by the Port Construction Representative. Refer to the excerpt from the aforementioned document attached at the end of this Section for details.

B. No clearing and grubbing or rough cutting, other than as specifically directed by the Port Construction Representative, to allow soil testing and surveying, shall be permitted until erosion and sedimentation control systems are in place.

C. Install and maintain erosion and sedimentation control systems located within the project site prior to the start of construction under this Contract until final site stabilization or until approval is received from the Port Construction Representative to remove and discard the existing system.

D. Inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until final site stabilization. Remove erosion and sedimentation control systems promptly upon approval of the Port Construction Representative. Discard removed materials offsite.
E. All sediment generated during construction will remain on the Project site. Sediment should be spread, compacted and stabilized in accordance with the Port of Houston Authority Municipal Separate Storm Sewer System (MS4) Permit Program. Sediment shall not be allowed to flush into stream or drainage way. If any contaminated sediment is encountered, the Contractor shall notify the Port of Houston Authority Environmental Affairs Manager.

F. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soils in a maximum of 8-inch layers. Compaction density shall be at a minimum of 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.

G. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

H. Conduct all construction operations under this Contract in conformance with the erosion control practices described in the Project Storm Water Pollution Prevention Plan.

3.2 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits and truck washing areas, when approved by Port Construction Representative, of sizes and at locations shown on Drawings or as specified in this Section.

C. Vehicles leaving construction areas shall have the tires cleaned to remove sediment prior to entrance onto public right-of-ways. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas which drain into sediment traps.

D. Details for stabilized construction exits are shown on Drawings. Construct other stabilized areas to same requirements. Maintain minimum roadway widths of 14 feet for one-way traffic and 20 feet for two-way traffic and of sufficient width to allow ingress and egress. Place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Limit exposure of geotextile fabric to elements between laydown and cover to a maximum 14 days to minimize potential damage.

E. Grade roads and parking areas to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar materials to prevent sediment from entering public right-of-ways, receiving streams or storm water conveyance systems.

F. Inspect and maintain stabilized areas daily. Provide periodic top dressing with additional coarse aggregates to maintain required depth. Repair and clean out damaged control systems used to trap sediment. Immediately remove spilled, dropped, washed, or tracked sediment from public right-of-ways.

G. Maintain lengths of stabilized areas as shown on Drawings or a minimum of 50 feet. Maintain a minimum thickness of 8 inches. Maintain minimum widths at all points of ingress or egress.

H. Stabilize other areas with the same thickness, and width of coarse aggregate required for stabilized construction exits, except where shown otherwise on Drawings.
I. Stabilized areas may be widened or lengthened to accommodate truck washing areas when authorized by Port Construction Representative.

J. Clean street daily before end of workday. When excess sediments have tracked onto streets, Port Construction Representative may direct Contractor to clean street as often as necessary. Remove and legally dispose of sediments.

K. Use other erosion and sediment control measures to prevent sediment runoff during rain periods and non-working hours and when storm discharges are expected.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 01 57 15.00 Add - CONCRETE TRUCK WASHING STRUCTURES

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the requirements for construction, maintenance and removal of concrete washout structures, as part of the Storm Water Pollution Prevention Plan (SWPPP), during construction and prior to the final development of the site.

1.2  SUBMITTALS

A. Contractor’s discretion on the type of washing structure to be used. Contractor to designate concrete washout structure to be used:
   1. Concrete washout structure constructed below grade as shown on Detail A, sheet 4 of this specification or
   2. Prefabricated concrete washout container as shown on Detail B, sheet 5 of this specification.
   3. Alternate washout structure as proposed by Contractor.

B. Submit site plan showing location(s) of concrete washout structure(s) for approval.

C. Material Disposal: Submit Plan for disposal of both concrete washout water and solid concrete wastes for approval.

1.3  MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for concrete washout structures to be provided by the contractor. Concrete Washout structures shall be provided in sufficient number and size for the construction of the project. No separate payment will be made for maintenance or removal of accumulated washout structure wastes.

B. Include cost for item as part of Temporary Storm Water Controls Section 01 57 23.00. Payment shall include and be full compensation for all labor, equipment, materials, supervision, signs and for all incidental expenses for the construction of these items, complete in place, including but not limited to embankment and excavation, protection of trees, maintenance requirements, repair and replacement of damaged sections, removal of deposits, redressing of aggregate, placement and repair of underlying geotextile fabric, and removal of erosion protection and sediment control systems after final stabilization.

Removal of the concrete washout structure and site restoration is incidental to the cost of the concrete washout structure. For the Below Grade Concrete Washout Structure shown on Detail A, the sandbags and geotextile are incidental to the cost of the concrete truck washout structure.
PART 2  PRODUCTS

2.1 CONCRETE TRUCK WASHOUT STRUCTURE

A. Below Grade Concrete Washout Structure with sand bags. Refer to attached Detail – A, page 4 of this specification.

B. Portable Concrete Washout Container with Ramps, such as provided by American Concrete Washout, Inc. or approval equal.

PART 3  EXECUTION

3.1 PLACEMENT

A. Do not locate concrete washout structures within 50 feet of storm drain inlets, open drainage facilities or watercourses.

B. Locate away from construction traffic or access areas to prevent disturbance or tracking.

3.2 CONSTRUCTION

A. Install a sign adjacent to each temporary concrete washout structure to inform concrete equipment operators to utilize the proper facilities. See attached Detail sheets for sign dimensions.

B. Detail A -Below Grade Concrete Truck Washout Structure with Sandbags.

1. Construct temporary concrete washout structures below grade with a minimum length and width of 10 feet. Construct and maintain concrete truck washout structures in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

2. Remove rocks and other debris in soil base of structure that might tear or puncture the plastic lining.

3. Provide plastic lining material which is a minimum of 10-mil thick polyethylene sheeting. Sheeting shall be free of holes, tears or other defects that compromise the impermeability of the lining. Install lining seams in accordance with manufacturers’ recommendations.

4. Install 15 feet by 35 feet by 8 inches thick granular fill truck parking pad underlain with geotextile per Item 724 -Stabilized Construction Access.

5. Install orange safety fence around three sides of the structure as shown on Detail A.

C. Detail B -Place Portable Concrete Washout Container(s) as shown on the approved submittal.

3.3 MAINTENANCE

A. Once concrete wastes are washed into the designated structure and allowed to harden, break up the concrete remove and dispose in accordance with approved submittal.

B. Inspect lining integrity and level in concrete washout structure before each rainfall to prevent overtopping due to rainfall and daily during periods of daily rainfall and, at a minimum, once every week.
C. Repair or replace damaged lining or other damaged or missing parts of the washout structure immediately.

D. Maintain level in washout structure(s) to provide adequate holding capacity with a minimum freeboard of 12 inches.

E. Existing structure(s) must be cleaned, or new structure(s) constructed and ready for use once the washout structure is 75% full.

3.4 REMOVAL OF CONCRETE WASHOUT STRUCTURES

A. Once concrete washout structures are no longer required, as determined by the Port Construction Representative, remove and dispose the hardened concrete and concrete washout water per the approved submittal.

3.5 MATERIAL DISPOSAL

A. Dispose materials used to construct truck washout structure(s) and granular fill parking pad(s) properly.

B. Remove unusable, objectionable or excess material from the construction work area. Properly dispose of such material.

C. Disposal of material in the 1DO-year flood plain without permits is prohibited.

D. Disposal of material in wetlands or other environmentally sensitive areas without permits is prohibited.

E. Material disposed of without permits shall be removed and properly disposed of at no cost to the County. Restore the site at no cost to the County.

F. Cleared and grubbed material may be chipped on-site and chips disposed of in areas approved by the Port Construction Representative, provided the following items are adhered to:

1. Scatter chips sufficiently to prevent killing turf grass or other desirable vegetation.

2. Dispose of excess chips in accordance with this Item.

3.6 SIRE RESTORATION

A. Compact clean fill in pit up to surrounding grade.

B. Backfill and repair all holes, depressions or other ground disturbances caused by the construction and removal of the concrete washout structure(s).

C. Restore concrete washout structure area to match surrounding grade and vegetation.
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL
SECTION 01 57 23.00 Add - TEMPORARY STORM WATER CONTROLS

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the installation of erosion and sedimentation controls during construction as described in the construction Storm Water Pollution Prevention Plan (SWPPP). The SWPPP ensures the project complies with the Port of Houston Authority Municipal Separate Storm Sewer Systems (MS4) Permit Program. Additionally, the preparation and implementation of a SWPPP is required for storm water discharges from sites associated with construction activity under the National Pollutant Discharge Elimination System (TPDES) General Permit No. TXR150000 (26 TAC § 26.040).

B. The Contractor shall implement and maintain the SWPPP throughout the course of the Work until final site stabilization. The Contractor, as the party in daily operational control of the Project site, shall conduct all construction activities in compliance with all applicable storm water control requirements and shall assume responsibility for conformance with these requirements.

1.2  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. As applicable, Storm Water Pollution Prevention Plan (SWP3) or Best Management Practices (BMP) Plan drawing. The Erosion Control Plan provided in the Contract Drawings represents a minimum level of effort needed for Best Management Practices. Contractor shall provide a detailed Storm Water Pollution Prevention Plan (SWPPP) 30 days prior to the start of field activities in conformance with the guidelines established by the Port of Houston Authority Municipal Separate Storm Sewer Systems (MS4) Permit Program and TPDES requirements, to the Port Construction Representative for approval.

C. The Contractor, along with all Inspectors and Subcontractors, shall certify that the terms and conditions of the TPDES General Permit No. TXR150000 are understood. Certification forms to be submitted are provided in the Project SWPPP.

D. Appendix A, Storm Water Pollution Prevention Plan, contains verbiage describing BMPs to be utilized. Contractor shall submit for inclusion with the Storm Water Pollution Prevention Plan, reports summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the storm water pollution prevention plan (see forms provided as part of this specification), and actions taken in accordance with Paragraph 3.2, INSPECTIONS and Paragraph 3.3 MAINTENANCE will be made by the Contractor and retained by the Contractor as part of the SWPPP for at least three years from the date that the site is finally stabilized. The report, or sections of the report, will be made available to the Port Construction Representative at any time during the duration of the work or the period following site stabilization. A final copy of the report in its entirety shall be submitted to the Port Construction Representative upon its completion. The

CSP Date: April 1, 2014 01 57 23.00 Add TEMPORARY STORM WATER CONTROLS
report will be signed in accordance with Chapter 30 of the Texas Water Code (30 TAC § 305.128).

E. The Contractor shall submit to the Port Construction Representative copies of all other documentation related to the SWPPP and required by the Contract Documents, the Port of Houston Authority Municipal Separate Storm Sewer System (MS4) Permit Program and TPDES General Permit No. TWR150000 (26 TAC § 26.040).

F. Notice of Intent:

The Contractor will submit a Notice of Intent (NOI), with the applicable fee to the Texas Commission on Environmental Quality (TCEQ), as a requirement of the General TPDES Permit for Storm Water Discharges associated with Construction Activities. Before submitting to the TCEQ, the Contractor shall submit the “Draft” NOI to the Port Authority for review and approval. A blank NOI and instructions are provided in the Project SWPPP. Contractor is responsible for completion and submittal of the NOI, latest edition.

The Contractor, along with its subcontractors, will be required to certify that the terms and conditions of the General TPDES Permit are understood and being implemented.

The Chief Construction Manager will coordinate all submittals with the Contractor for the TPDES General Permit.

G. Notice of Termination (if applicable):

The Contractor will submit a Notice of Termination (NOT) to the Texas Commission on Environmental Quality and a copy to the Port Authority (as the MS4) within 30 days, after final stabilization has been achieved on all portions of the site, or another permitted operator has assumed control over all areas of the site that have not been finally stabilized, and all silt fences and other temporary erosion controls have been either removed or transferred to a new operator if the new operator has attained permit coverage before submitting to the TCEQ, the Contractor shall submit the “Draft” NOT to the Port Authority for review and approval.

1.3 REFERENCES

A. Texas Pollutant Discharge Elimination System (TPDES) General Permit


C. Compliance with all applicable and appropriate local, state and federal waste disposal and sanitary sewer regulations.

D. Chapter 26 of the Texas Water Code (Section 26.040), and Section 402 of the Clean Water Act.

E. Storm Water Quality Management Guidance Manual, Prepared by the City of Houston, Harris County, Harris County Flood Control District; Latest Edition.

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, all components for Temporary Storm Water Controls shall be paid for on a Lump Sum basis including the Storm Water Pollution Prevention Plan, Reinforced Filter Fabric Barriers (01 57 13.01), Concrete Truck Washing Structures (01 57 15.00), and Stabilized Construction Entrance/Exit (01 57 14.00), Hydromulch Seeding
(32 92 13.00) and other incidentals required to stabilize the site. Lump Sum price shall include the SW3P application, NOI, NOT inspection, maintenance, and reporting including updates to the Erosion Control Plan required to comply with the SWPPP as described herein and shall include associated costs, fees, labor, materials, and incidentals necessary to meet the requirements of this Section and the Plans.

B. Other: No separate payment will be made for any other associated items or BMPs, including but not limited to the Contractor’s waste disposal and the impoundment for drums, fuel and chemical storage. These items will be considered incidental to the Contractor’s operations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Contractor shall locate and maintain any existing materials required for storm water pollution prevention as shown on the Drawings and in conformance with these specifications and the Project SWPPP.

B. Refer to Section 01 57 23.00 - Temporary Storm Water Controls.

C. Refer to Section 01 57 13.01 – Temporary Erosion and Sediment Controls

D. Refer to Section 01 57 14.00 – Stabilized Construction Entrance

E. Refer to Section 01 57 15.00 – Concrete Truck Washout Structures

F. Refer to Section 32 92 13.01 - Hydromulching.

PART 3 EXECUTION

3.1 CONTROLS

A. General: Erosion and sediment controls are described in the Project SWPPP. Erosion and sediment controls (stabilized construction entrance, reinforced filter fabric barrier, and concrete truck washout structures) shall be installed by the Contractor. Contractor shall maintain all storm water management controls related to sediment runoff located on portions of the site for which the Contractor is responsible.

B. Sequence of Major Erosion and Sediment Control Activities: All of the structural controls, including the inlet protection barriers, filter fabric fence and sediment basins, should be installed prior to construction. No excavation or grading shall be permitted until erosion and sedimentation control systems are in place. Projects should be staged to minimize the disturbed area, as practical.

C. Good Housekeeping: As practicable, the site will be maintained in an orderly manner. Routine site housekeeping in accordance with acceptable industry practices will be conducted on a regular basis.

D. Stabilization Practices:

1. Staging and parking areas will be stabilized by the Contractor using a coarse aggregate.
2. The Contractor shall maintain hydro-mulch seeding on all sediment basin side slopes, diversion dikes and swales located on portions of the site for which the Contractor is responsible.

3. Contractor shall comply with additional project specific stabilization methods described in the Project SWPPP.

E. Structural Practices:

1. Structural practices will be as described in the Project SWPPP.

2. All the structural controls, including reinforced filter fabric barrier, stabilized construction entrance and concrete truck washout structures, shall be maintained by the Contractor during the course of the work, or until another permitted operator or contractor has assumed control over all areas of the site that have not been finally stabilized.

3. Offsite Vehicle Tracking: The contractor will minimize offsite vehicles onto the site and minimize the generation of dust. A stabilized site entrance shall be in place to reduce the tracking of sediments.

4. Drums, Fuel and Chemical Storage:

   a. An impoundment shall be constructed to hold all drums, aboveground fuel tanks, chemicals and fuel. The area will be lined with visqueen and have a volume of at least 150 percent of the capacity of all containers within its bounds. A 4-inch sand layer shall be placed on top of the visqueen in order to stabilize it and minimize the damage to the liner. The Contractor should refer to manufacturers warnings to prevent storing materials together that, when mixed, are a hazard. If this potential exists, multiple impoundments should be constructed.

   b. The impoundment shall be covered to protect the area from precipitation. The area may be covered by a method of the Contractor’s choice, subject to approval by the Port Construction Representative. The cover should extend over the edge of the impoundment half the distance of the cover height; if the cover is 7 feet above the impoundment, the edges should extend 3.5 feet horizontally over the edges of the impoundment.

   c. The impoundment should be removed only after materials are no longer stored on site.

   d. Sediment Basins: Construction of the sediment basin will be performed by excavation or the erection of an earthen embankment across a low area or drainage swale. The design specification will be provided on the Construction Drawings.

5. Other Controls:

   a. Materials Brought On-Site:

      The Contractor will provide the Port Authority with copies of Material Safety Data Sheets (MSDS) for all materials brought on site. Materials will be managed appropriately in consideration of the MSDS.

   b. Waste Materials:

      1. Trash and Debris:

         All waste will be collected and stored on site. Construction debris, trash and any construction chemicals will be stored in a manner that prevents them from potentially impacting the quality of rainfall
2. **Hazardous Waste:**
   The contractor is not allowed to bring any hazardous waste on site that has not been generated directly as a result of the construction activity authorized by the Port Authority.

   Any hazardous waste generated directly as a result of the construction activity authorized by the Port Authority will be stored inside a visqueen lined impoundment. Collected hazardous wastes will be appropriately managed complying with all local, state, and federal environmental regulations and requirements.

   Spill practices will adhere to industry standards for spill response. Collected spill materials, if any will be managed appropriately including but not limited to proper handling, proper labeling of drums, proper disposal of materials, and proper reporting and recordkeeping.

3. **Sanitary Waste:**
   All sanitary waste will be regularly collected from the portable units by a licensed sanitary waste management contractor.

4. **Concrete Washout Controls**
   When it is required to have a concrete washout area it shall be a lined concrete washout pit which is cleaned out and maintained throughout the term of the project.

5. **Compliance with State and Local Regulations:**
   The proposed project will be in compliance with all applicable and appropriate local, state and federal waste disposal and sanitary sewer regulations.

6. **Controls**
   Controls are discussed in the Project SWPPP. They include waste disposal, offsite vehicle tracking, and storage of construction materials and chemicals. The Contractor is responsible for obtaining and adhering to the provisions of the referenced Storm Water Management Handbook for Construction Activities, or other industry standards as approved by the Port Construction Representative.

7. **Contractor’s Compliance**
   The Contractor shall adhere to the guidelines presented in the Project SWPPP throughout the duration of construction.

### 3.2 INSPECTIONS

A. The Contractor will designate a qualified person or persons to perform the following inspections:

1. Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system.
2. Erosion and sediment control measures identified in the project SWPPP will be observed to ensure that they are operating correctly.
3. Where discharge locations or points are accessible, they will be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.
4. Locations where vehicles enter or exit the site will be inspected for evidence of offsite sediment tracking. Streets used for entering or leaving the job area shall be kept free of excavated material, debris, and any foreign material resulting from construction operations.
5. Locations where chemicals to be stored on site will be inspected for evidence of storm water contamination.
6. The concrete wash truck wash area will be inspected for loss of aggregate, proper drainage and proper maintenance of the pit and washing equipment.

B. The inspections will be conducted at least once every fourteen (14) calendar days and within 24 hours after a storm of 0.5 inch or greater.
C. After a portion of the site is finally stabilized, inspection will be conducted at least once every month.
D. Based on the results of the inspection, the control measures of project SWPPP will be revised as appropriate, but in no case later than seven (7) calendar days following the inspection.
E. Example inspection forms, to be customized for specific stabilization, structural, and other controls, are included at the end of this Technical Specification.

3.3 MAINTENANCE

A. The maintenance and repairs of the erosion and sediment controls will be conducted within 24 hours of the inspection reports (See Paragraph Inspections).
B. Contractor shall repair or replace damaged sections of reinforced filter fabric barrier, and shall remove sediment deposits when silt reaches one-third of the height of the barrier in depth.
C. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project is accepted by the Chief Construction Manager. Remove erosion and sedimentation control systems promptly when directed by the Chief Construction Manager. Discard removed materials offsite at an approved disposal location.
D. Damages caused by construction traffic to erosion and sedimentation control system shall be repaired immediately.

3.4 NOTICE OF INTENT

A. A Notice of Intent (NOI) shall be submitted by the Port of Houston Authority and the Contractor as co-permittees at least two (2) days prior to the initial disturbance of soils associated with clearing, grading, excavation activities, or other construction activities, in accordance with the requirements of the TPDES General Permit No. TXR150000 (26 TAC § 26.040).
B. The SWPPP must be fully developed and implemented by the Contractor prior to submitting the NOI. There will be no separate payment for fees associated with submitting and reviewing NOI's.
C. A blank NOI and instructions for its completion are provided in the Project SWPPP.
3.6 COMPLETION

A. All erosion and sediment control systems should be removed only after the project has been completed or final stabilization has been achieved on all portions of the site. Generally, final stabilization is achieved when all soil disturbing activities at the site have been completed and a 70 percent uniform perennial vegetative cover has been established on all unpaved areas or equivalent permanent stabilization measures have been employed.

Removal of the erosion and sediment control systems should be done with the concurrence of the Chief Construction Manager.

Erosion controls that are designed to remain in place for an indefinite period, such as mulches are not required to be removed.

B. The impoundment should be removed only after materials are no longer stored onsite.

3.7 NOTICE OF TERMINATION

A. Contractor will submit a Notice of Termination (NOT) to the Port Construction Representative as the final task of the TPDES General Permit No. TXR150000 (26 TAC § 26.040). The submittal of the NOT is required under the Construction General Permit and communicates to the permit enforcement agency that construction activity has ceased. There will be no separate payment for fees associated with submitting NOT’s.

B. The NOT will be submitted to Texas Commission on Environmental Quality (TCEQ) within thirty days after:

1. Final stabilization has been achieved on all portions of the site that is the responsibility of the Contractor; or
2. Another permitted operator or contractor has assumed control over all areas of the site that have not been finally stabilized; and
3. All silt fences (including Reinforced Filter Fabric Barriers) and other temporary erosion controls have either been removed, scheduled for removal as defined the Conditions, or SWPPP; or transferred to a new operator if the new operator has sought permit coverage. Erosion controls that are designed to remain in place for an indefinite period, such as mulches and fiber mats, are not required to be removed or scheduled for removal.

C. A blank NOT and instructions are provided in the Project SWPPP. Contractor is responsible for completion and submittal of the NOT.
STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT

INSPECTOR:____________________________  DATE:___________________________

DAYS SINCE LAST RAINFALL:_____    AMOUNT OF LAST RAINFALL:_____INCHES

STABILIZATION MEASURES

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TO BE PERFORMED BY: _______________ ON OR BEFORE: _______________
### STORM WATER POLLUTION PREVENTION PLAN
### INSPECTION AND MAINTENANCE REPORT

#### STRUCTURAL CONTROLS

**REINFORCED FILTER FABRIC BARRIER:**

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<tr>
<th>LOCATION</th>
<th>BOTTOM OF FABRIC STILL BURIED?</th>
<th>FABRIC TORN OR SAGGING?</th>
<th>POSTS TIPPING OVER?</th>
<th>HOW DEEP IS THE SEDIMENT?</th>
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**TO BE PERFORMED BY:** ________________  **ON OR BEFORE:** __________
## STORM WATER POLLUTION PREVENTION PLAN
### INSPECTION AND MAINTENANCE REPORT

#### STRUCTURAL CONTROLS

**DIVERSION DIKE AND SWALE:**

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<tr>
<th>LOCATION</th>
<th>DIKE AND SWALE CONDITION</th>
<th>DIKE AND SWALE DIMENSIONS AS SPECIFIED</th>
<th>PROJECTIONS OR OTHER IRREGULARITIES IMPEDING FLOW</th>
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**MAINTENANCE REQUIRED FOR DIVERSION DIKE AND SWALE:**

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**TO BE PERFORMED BY:** ____________________ **ON OR BEFORE:** ________________
STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT

STRUCTURAL CONTROLS

SEDIMENT BASIN WITH PIPE OUTLET:

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<thead>
<tr>
<th>LOCATION</th>
<th>SEDIMENT BASIN CONDITION</th>
<th>DEPTH OF SEDIMENT</th>
<th>SEDIMENT BASIN DIMENSIONS SPECIFIED</th>
<th>PIPE OUTLET CONDITION</th>
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MAINTENANCE REQUIRED FOR SEDIMENT BASIN WITH PIPE OUTLET:

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TO BE PERFORMED BY: _______________ ON OR BEFORE: _______________
STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT

OTHER CONTROLS

STABILIZED CONSTRUCTION ENTRANCE/STAGING AREA:

<table>
<thead>
<tr>
<th>DOES MUCH SEDIMENT GET TRACKED ONTO ROAD?</th>
<th>ENTRY SURFACE CLEAN OR SEDIMENT FILLED?</th>
<th>DOES ALL TRAFFIC USE ENTRANCE?</th>
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MAINTENANCE REQUIRED FOR STABILIZED CONSTRUCTION ENTRANCE/STAGING AREA:

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TO BE PERFORMED BY: _______________________ ON OR BEFORE: ______________

CSP Date: April 1, 2014
### STORM WATER POLLUTION PREVENTION PLAN
### INSPECTION AND MAINTENANCE REPORT
### OTHER CONTROLS
### CHEMICAL STORAGE:

<table>
<thead>
<tr>
<th>Evidence Chemical Containment Device Has Overtopped?</th>
<th>Removal of Waste Material Required?</th>
<th>Evidence of Storm Water or Groundwater Contamination?</th>
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### Maintenance Required for Chemical Storage Area:

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**To Be Performed By:** ______________________ **On or Before:** ______________________
STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT

CHANGES REQUIRED TO THE POLLUTION PREVENTION PLAN:

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REASONS FOR CHANGES:
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INSPECTOR’S SIGNATURE: __________________________ DATE: ______________

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 01 57 25.00 Add - GROUND WATER AND SURFACE WATER CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes:

1. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations, and foundation beds in a stable condition, and controlling ground water conditions for tunnel excavations.
2. Protecting work against surface runoff and rising flood waters.
3. Disposing of removed water.

1.2 RELATED SECTIONS

A. 01 57 23.00 – Temporary Storm Water Controls
B. 31 41 33.00 – Trench Safety System
C. 33 31 00.00 – Acceptance Testing for Sanitary Sewers

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

A. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49 kg) Rammer and 12-inch (304.8 mm) Drop.
C. Chapter 26 of the Texas Water Code (Section 26.040) and Section 402 of the Clean Water Act.

1.4 MEASUREMENT AND PAYMENT

A. Subject to section III, no separate payment shall be made for work under this section. Include payment in unit price items for which Ground Water and Surface Water Control is a component.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit a Ground Water and Surface Water Control Plan for review by the Port Construction Representative prior to start of any field work. The Plan shall be signed by a Professional Engineer registered in the State of Texas. Submit a plan to include the following:

1. Results of subsurface investigation and description of the extent and characteristics of water bearing layers subject to ground water control.
2. Names of equipment suppliers and installation subcontractors.
3. A description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria, and operation and maintenance procedures.

4. A description of proposed monitoring and control system indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics.

5. A description of proposed filters including types, sizes, capacities and manufacturer's application recommendations.

6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.

7. Operating requirements, including piezometric control elevations for dewatering and depressurization.

8. Excavation drainage methods including typical drainage layers, sump pump application and other necessary means.

9. Surface water control and drainage installations.

10. Proposed methods and locations for disposing of removed water.

C. Submit the following records upon completed initial installation:

1. Installation and development reports for well points, eductors, and deep wells.

2. Installation reports and baseline readings for piezometers and monitoring wells.

3. Baseline analytical test data of water from monitoring wells.

4. Initial flow rates.

D. Submit the following records on a weekly basis during operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.2, Requirements for Eductor, Well Points, or Deep Wells.

2. Maintenance records for ground water control installations, piezometers, and monitoring wells.

E. Submit the following records at end of work. Decommissioning (abandonment) reports for monitoring wells and piezometers installed by other during the design phase and left for Contractor's monitoring and use.

1.6 DEFINITIONS

A. Ground water control includes both dewatering and depressurization of water-bearing soil layers.

1. Dewatering includes lowering the water table and intercepting seepage, which would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts, and disposing of removed water. The intent of dewatering is to increase stability of tunnel excavations and excavated slopes; prevent dislocation of material from slopes or bottoms of excavations; reduce lateral loads on sheeting and bracing; improve excavating and hauling characteristics of excavated material; prevent failure or heaving of the bottom of excavations; and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.

2. Depressurization includes reduction in piezometric pressure within strata not controlled by dewatering alone, as required to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage includes keeping excavations free of surface and seepage water.

C. Surface drainage includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines as required to protect the Work from any source of surface water.
D. Equipment and instrumentation for monitoring and control of the ground water control system includes piezometers and monitoring wells, and devices, such as flow meters, for observing and recording flow rates.

1.7 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems.

B. Design a ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Section 31 41 33.00 - Trench Safety System, to produce the following results:

1. Effectively reduce the hydrostatic pressure affecting:
   a. Excavations.
   b. Tunnel excavation, face stability or seepage into tunnels.

2. Develop a substantially dry and stable subgrade for subsequent construction operations.

3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities, and other work.

4. Prevent the loss of fines, seepage, boils, quick condition, or softening of the foundation strata.

5. Maintain stability of sides and bottom of excavations.

C. Provide ground water control systems may include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from any other source entering the excavation. Excavation drainage may include placement of drainage materials, such as crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and any settlement or resultant damage caused by the ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, or affect potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of the system to protect property as required.

H. Provide an adequate number of piezometers installed at the proper locations and depths as required to provide meaningful observations of the conditions affecting the excavation, adjacent structures, and water wells.

I. Provide environmental monitoring wells installed at the proper locations and depths as required to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into the work area or into the ground water control system.

J. Decommission piezometers and monitoring wells installed during design phase studies and left for Contractors monitoring and use.
1.8 ENVIRONMENTAL REQUIREMENTS

A. Comply with Texas Commission on Environmental Quality (TCEQ) regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

B. Obtain permit (TXR150000) from TCEQ under the Texas Pollutant Discharge Elimination System (TPDES), for storm water discharge from construction sites, pursuant to Section 26.040 of the Texas Water Code and Section 402 of the Clean Water Act.

C. Comply with the requirements of Section 01 57 23.00 – Temporary Storm Water Controls.

D. Monitor ground water discharge for contamination while performing pumping in the vicinity of potentially contaminated sites.

PART 2 PRODUCTS

2.1 Equipment And Materials

A. Equipment and materials are at the option of Contractor as necessary to achieve desired results for dewatering.

B. Eductors, well points, or deep wells, where used, must be furnished, installed and operated by an experienced contractor regularly engaged in ground water control system design, installation, and operation.

C. All equipment must be in good repair and operating order.

D. Sufficient standby equipment and materials shall be kept available to ensure continuous operation, where required.

PART 3 EXECUTION

3.1 Ground Water Control

A. Perform a subsurface investigation by borings as necessary to identify water bearing layers, piezometric pressures, and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine the drawdown characteristics of the waterbearing layers. The results shall be presented in the Ground Water and Surface Water Control Plan (See Paragraph 1.6B.1).

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in a manner compatible with construction methods and site conditions. Monitor effectiveness of the installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify the Port Construction Representative in writing of any changes made to accommodate field conditions and changes to the Work. Provide revised drawings and calculations with such notification.

D. Provide for continuous system operation, including nights, weekends, and holidays. Arrange for appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify that the system lowers ground water piezometric levels at a rate required to maintain a dry excavation resulting in a stable subgrade for prosecution of subsequent operations.

F. Where hydrostatic pressures in confined water bearing layers exist below excavation, depressurize those zones to eliminate risk of uplift or other instability of excavation or installed works. Allowable piezometric elevations shall be defined in the Ground Water and Surface Water Control Plan.
G. Remove ground water control installations.
   1. Remove pumping system components and piping when ground water control is no longer required.
   2. Remove piezometers, including piezometers installed during the design phase investigations and left for Contractor’s use, upon completion of testing, in accordance with Section 33 31 00.00 - Acceptance Testing of Sanitary Sewers.
   3. Remove monitoring wells when directed by the Port Construction Representative.
   4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

H. During backfilling, dewatering may be reduced to maintain water level a minimum of 5 feet below prevailing level of backfill. However, do not allow that water level to result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement stabilized sand until at least 48 hour after placement.

I. Provide a uniform diameter for each pipe drain run constructed for dewatering. Remove pipe drain when it has served its purpose. If removal of pipe is impractical, provide grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout when pipe is removed from service.

J. Extent of construction ground water control for structures with a permanent perforated underground drainage system may be reduced, such as for units designed to withstand hydrostatic uplift pressure. Provide a means of draining the affected portion of underground system, including standby equipment. Maintain drainage system during operations and remove it when no longer required.

K. Remove system upon completion of construction or when dewatering and control of surface or ground water is no longer required.

L. Compact backfill to not less than 95 percent of the maximum dry density in accordance with ASTM D 698.

3.2 Requirements For Eductor, Well Points, Or Deep Wells

A. For aboveground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between every eductor well or well point and discharge header so that discharge from each installation can be visually monitored.

B. Install sufficient piezometers or monitoring wells to show that all trench or shaft excavations in water bearing materials are predrained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for Contractor’s selected method of work.

C. Install piezometers or monitoring wells not less than one week in advance of beginning the associated excavation.

D. Dewatering may be omitted for portions of underdrains or other excavations, but only where auger borings and piezometers or monitoring wells show that soil is predrained by an existing system such that the criteria of the ground water control plan are satisfied.

E. Replace installations that produce noticeable amounts of sediments after development.

F. Provide additional ground water control installations, or change the methods, in the event that the installations according to the ground water control plan does not provide satisfactory results based on the performance criteria defined by the plan and by the specification. Submit a revised plan according to Paragraph 1.6B.
3.3 Excavation Drainage

Contractor may use excavation drainage methods if necessary to achieve well drained conditions. The excavation drainage may consist of a layer of crushed stone and filter fabric, and sump pumping in combination with sufficient wells for ground water control to maintain stable excavation and backfill conditions.

3.4 Maintenance And Observation

A. Conduct daily maintenance and observation of piezometers or monitoring wells while the ground water control installations or excavation drainage are operating in an area or seepage into tunnel is occurring. Keep system in good condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedule.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make observations, as specified.

D. Remove and grout piezometers inside or outside the excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by the Port Construction Representative.

3.5 Monitoring And Recording

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also monitor and record water level and ground water recovery. These records shall be obtained daily until steady conditions are achieved and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until the Work is completed or piezometers or wells are removed, except when the Port Construction Representative determines that more frequent monitoring and recording are required. Comply with Port Construction Representative’s direction for increased monitoring and recording and take measures as necessary to ensure effective dewatering for intended purpose.

3.6 Surface Water Control

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. The requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains or sediment basins, as approved by the Port Construction Representative.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 02 30 00.00 Add - BUILDING PAD, DUG FOUNDATIONS AND FOOTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to General and Special Conditions, this section shall comply with provisions and requirements of all Contract Documents.

1.2 RELATED SECTIONS

A. 03 30 00.00 – Cast-in-Place Concrete

1.3 REFERENCES

A. ASTM C33 – Standard Specification for Concrete aggregates
B. ASTM D 2481 – Classification of Soils for Engineering Purposes

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payments shall be made for work under this section. Include price of building pad, dug foundations and footings in the unit price of items for which building pad, dug foundations and footings are components.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

PART 2 PRODUCT

2.1 MATERIALS

A. Materials, as listed below, shall conform to the requirements listed therefore under PART 2 of the Cast-In-Place Concrete Section of these Specifications for this Project.

1. Portland Cement
2. ASTM C-33 Aggregates
3. Water
4. Metal Reinforcement
5. Metal Accessories

B. Building Pad (2-inch compacted sand): Clean, durable sand meeting grading requirements for fine aggregates of ASTM C33 or durable bank sand classified as SP,
SW, or SM by Unified Soil Classification System (ASTM D 2487).

C. Structural Backfill:

1. Material used for structural backfill shall be graded free of lumps greater than 6 inches, rocks larger than 3 inches, organic material, chemical waste or other contamination, and debris.

2. Material shall have a plasticity index not less than 12, nor more than 20 when tested in accordance with ASTM D 4318. Maximum liquid limit shall be 45. Do not use a blend of cohesive and granular soils to achieve the required plasticity index.

PART 3 PROCEDURES

3.1 LINES AND GRADES: Contractor shall lay out and correctly establish all lines, levels, grades and positions of all parts of the work, and shall be responsible for their accuracy and proper correlation with existing control lines, monuments, and data points. Control lines, monuments and data points shall be carefully preserved by Contractor, and if displaced, shall be re-set by Contractor at Contractor's own expense. All such re-setting work shall be subject to Port Construction Representative's approval.

3.2 DRAINAGE AND PUMPING: Contractor shall be responsible for maintaining all foundation and footing excavations free from water throughout the progress of the work. Water shall be kept constantly controlled and legally disposed of by means of pumps, ditches, dams and other acceptable methods.

PART 4 EXECUTION

4.1 PROTECTION OF BEARING SOIL: Keep at normal moisture content until concrete is poured. Protect from premature drying by a minimum 3” thick 3000 psi concrete seal slab. Protect from water softening by pumping. If Contractor fails to protect the bearing soil, Contractor shall remove the damaged soil and extend footing depth at no expense to The Port Authority.

4.2 SUB-SOIL CONDITIONS:

1. Suitability: Contract is to be based on the earth being suitable for footings and foundations at the depths shown.

2. Depths: Those shown on the Drawings are minimums and may be increased to obtain acceptable bearing as directed by The Port Construction Representative.

4.3 FOOTING CLEANLINESS: Loose dirt and debris shall be removed prior to concreting.

4.4 EXCAVATION INSPECTION: Do not pour any footing prior to inspection by the Port Authority. Concrete shall be placed promptly after inspection before any change in the excavation takes place.

4.5 CONCRETE PLACING: Materials and procedures shall conform to applicable requirements of Section 03 30 00.00.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 02 41 13.13 Add - REMOVAL OF EXISTING PAVEMENT AND STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes remove and dispose or remove and stockpile of All Existing Items Within the Project Work Limits and As Described in Plan Drawings:

1. buildings and canopies.
2. concrete paving, asphaltic concrete pavement, and base courses, regardless of thickness.
3. concrete curbs, concrete curbs and gutters, sidewalks and driveways, regardless of thickness.
4. Gravel areas.
5. concrete barrier.
6. chain link fence, gates.
7. pipe culverts and RCBs, regardless of Type and Size, headwalls.
8. existing water and sewer pipe inlets and manholes.
9. conduit and overhead electrical, including poles, guys.
10. Covered Area/Canopy Including Concrete, Posts and Electrical Box
11. electrical wire, overhead and underground including conduit, utility poles and other miscellaneous items.
12. light standards, posts and cameras.
13. wood posts, metal posts, signs, foundations and other miscellaneous items.
14. stormwater quality pond outlet and associated overflow structure.
15. weigh scales.
16. pedestrian ramps.
17. license plate camera pedestal.
18. miscellaneous structures of concrete or masonry.
19. pump stations.

1.2 RELATED SECTIONS

A. 31 23 35.00 – Excavation and Backfill for Utilities

1.3 REFERENCES (Not Used)

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, measurement and payment for remove and dispose OR remove and stockpile or relocate shall be on a lump sum basis for all items as shown on the Contract Drawings or located within the project limits of construction. Lump Sum price shall include coordination with PHA Construction Manager, Operations and Security, and utility companies or others (as needed) and all necessary permits.
B. No separate payment shall be made for hauling, disposal, or for protection of items to remain, or for dust control or other items, equipment or labor needed to complete the work.

C. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section. Costs for saw cutting are to be included in items for which saw cutting is a component.

D. No payment will be made for work outside maximum payment limits indicated on Drawings, or for pavements or structures removed for the Contractor's convenience.

1.5 MEASUREMENT AND PAYMENT – MANHOLE REHABILITATION

A. Payment for ‘Remove Abandoned Cables’ for electrical cable removal, shall be on a unit price basis per Each manhole, for locating both ends of each cable and removing them in their entirety. Any damage to surrounding systems shall be repaired as part of this item.

B. Refer to Special Conditions Item 10 - Measurement and Payment for unit price procedures.

C. Expected quantities are shown on plan sheet E-169A. Quantities on the bid form may exceed expected quantities to allow for unforeseen conditions.

1.6 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.7 REGULATORY REQUIREMENTS

A. The Contractor shall obtain all necessary permits for completing demolition procedures at no cost to the Port of Houston Authority.

B. The Contractor shall conform to all standards regarding demolition of pavement and structures, safety of adjacent structures and dust control.

C. The Contractor shall coordinate removal work with applicable utility companies.

PART 2 PRODUCTS

2.1 MATERIALS

A. The Contractor shall furnish equipment and materials necessary to properly complete the required demolition.

PART 3 EXECUTION

3.1 PROTECTION

A. Execute demolition in a manner to prevent damage or displacement to the following:

1. Adjacent public and private property.
2. Trees, plants, and other landscape features designated to remain.
3. Pavement and utility structures designated to remain.
4. Bench marks, monuments, and existing structures designated to remain.

B. Minimize the spread of dust and flying particles by sprinkling water and other means.

3.2 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of 2 inches or one-half (1/2) the pavement thickness.

D. Where street and driveway saw cut locations coincide or fall within 3 feet of existing construction or expansion joints, break out to existing joint.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch-thick masonry plug in pipe end prior to backfill.

3.3 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Section 31 23 35.00 - Excavation and Backfill for Utilities. There will be no separate payment for backfill of trenches or holes associated with removals.

3.4 DISPOSAL

A. Stockpile.

1. When shown on plans Contractor shall stockpile demolished material in the placement area designated by the Port Construction Representative.
2. Contractor shall minimize occurrence of exposed rebar in stockpile of demolished material.

B. Removal. Removal and disposal of debris from the site resulting from work under this Section shall be in accordance with the requirements of the Waste Material Disposal section of the General Conditions.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 02 45 80.00 Add – TIMBER POLE PERFORMANCE SPECIFICATION

PART 1  GENERAL

1.1  SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the requirements for the provision of Timber Poles at the locations shown on the drawings. Contractor to furnish timber poles of sufficient strength and serviceability to mount Owner provided security cameras.

1.2  SUBMITTALS

A.  Product Data.  Submit complete descriptive product data for all material to be provided, including but not limited to, pole dimensions, material properties, pole layout, and protective coatings.

B.  Engineering Calculations.  Submit calculations prepared and sealed by a Professional Engineer, licensed in the State of Texas, shall be submitted for review and the Port Authority’s records.

1.3  RELATED SECTIONS

A.  None

1.4  REFERENCES


B.  ASTM D 25.

1.5  DESIGN REQUIREMENTS

A.  Pole Height.  Top of pole elevations shall be 60 feet above the finished pavement elevation, as shown on the drawings.

B.  Standard Design Loads.

1. Wind Loading – 130 MPH (Basic Wind Speed; 3-second gust).

C.  Deflection.  Maximum allowable deflection under specified loading conditions shall be L/120.

D.  Embedment Depth.  As determined by the delegated design professional engaged for the design of the timber poles.
1.6 MEASUREMENT AND PAYMENT

A. Payment for 'Temporary Camera Poles' shall be on a Lump Sum basis for all poles inclusive, for material, labor, equipment, and all other incidentals required, complete in place and accepted.

PART 2 PRODUCTS

2.1 PILES

A. **Timber.** Furnish treated piles of southern yellow pine impregnated with the specified preservative.

B. **Reference Standard.** Piles shall conform to the requirements of ASTM D 25. Supply in butt circumference as shown on the drawings and with tip circumference conforming to Table 1 of the reference standard. Splicing of piles will not be permitted except as otherwise shown or specified. Treated piles shall be clean-peeled. Untreated piles shall be rough-peeled.

PART 3 PROCEDURES

3.1 WARRANTY

A. In addition to the guarantee stated in the General Conditions, the Contractor shall ensure that the manufacturer warrants the poles and its components for one (1) year from the date of final completion of all Work.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 03 10 00.00 Add - CONCRETE FORMWORK

PART 1    GENERAL

1.1 SECTION INCLUDES

A. Subject to General and Special Conditions, this section shall comply with the provisions and requirements of all Contract Documents.

1.2 RELATED SECTIONS

A. 03 30 00.00 – Cast-in-Place Concrete

1.3 REFERENCES

A. ACI 347 – Recommended Practice for Concrete Formwork

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this section. Include price of Concrete Formwork in the unit price of items for which Concrete Formwork is a component.

1.5 SUBMITTALS (Not Used)

1.6 DESIGN

A. Work in accordance with Recommended Practice for Concrete Formwork, ACI 347, latest edition.

1. Conform to shapes, lines and dimensions on Drawings.
2. Prevent leakage of mortar.
3. Shore, brace and tie to maintain position and shape.
4. Determine formwork tolerance to insure cast concrete tolerances.
5. Formwork shall resist hydraulic conditions of pouring rate, temperature, vibrating, and retarding admixtures.

B. Do not use earth cuts as forms for vertical surfaces. However, grade beams are intended for monolithic placement on compacted fill.

1.7 WARRANTY

A. Manufacturer shall certify and guarantee, in writing, that his product shall perform as a concrete release agent, when applied according to instructions, in the following manner:
1. Will not stain concrete.
2. Suitable for use on forms of wood, steel, fiber, fiberglass, or concrete.
3. Will not impair the natural bonding character of any plaster, paint, or cementitious coating intended for use on concrete.

PART 2 PRODUCTS

2.1 MATERIALS

A. Forming Surfaces:
   1. Wood: Dressed to uniform thickness without loose knots or other defects.
   2. Steel: Rust free of galvanized form surfaces.

B. Form Release Agent:
   1. Approved Brands:
      (a) Nox-crete Form Coating, L&M “Debond” or approved equal.

C. Accessories:
   1. Ties and Hangers: Commercially manufactured.
   2. Spreader Cones: Not over 1 inch diameter.

D. Form Ties and Hangers:
   1. Type: Snap, threaded or removable type that permits removal of at least 1" from concrete faces. Use cone washers where exposed to view on exterior or in finished spaces.
   2. Wire: Not permitted where embedded in concrete unless no other tie method is feasible. Chip out and remove wire 1" from surfaces.

E. Bolts, Inserts, Sleeves (For related trades)
   1. Install items supplied by other trades where the items must be placed as forms are erected. Where these items can be installed after forms are completed, other trades shall install their own anchorage and sleeve devices. Locate these items from information supplied by the trades requiring them.

PART 3 EXECUTION

3.1 PLACING

A. Inspect formwork and earth cuts for freedom from debris, old concrete traces, pooled oil or water, strength and tightness.

B. Do not allow form release agent to contact either reinforcement or concrete against which fresh concrete will be placed. Wet board forms until joints are swelled shut.
3.2 **SEQUENCE OF FORM ERECTION**

First erect the side of the forms of the surface that will be exposed to view. When both sides will be exposed to view, erect the side having more importance first.

3.3 **SUITABILITY FOR FINISHES**

Surfaces produced as the result of this work are to be suitable for the various finishes specified in other sections. Refer to other sections for various finishes.

3.4 **TOP EDGES OF FORMS**

Use the form tops or a continuous strip to establish accurate top edges for beams, slabs and construction joints wherever the work will remain exposed to view.

3.5 **ACCURACY**

A. Complete concrete shall meet the following requirements where exposed to view on exterior or in finished interior spaces:

1. Visually plumb, level, straight and smooth when viewed at a distance of 30 ft. except for irregularities that will be removed in the finishing process.
2. Sufficiently accurate to accommodate the details of abutting work.
3. Measurably accurate so the maximum deviation is not over ¼” in 8'-0”.

3.6 **FORM REMOVAL**

A. Do not remove formwork until concrete has attained strength to support its own weight, live loads and additional construction loads and has hardened enough to prevent removal damage.

B. RENOVATION: Promptly clean and recondition used form surfaces.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to General and Special Conditions, provide complete, in place, all steel required for reinforcement of cast-in-place concrete as shown on the Drawings.

1.2 RELATED SECTIONS

A. 03 30 00.00 – Cast-in-Place Concrete

1.3 REFERENCES

A. ASTM A 82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
B. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made to work under this section. Include price of concrete reinforcement in the unit price of items for which concrete reinforcement is a component.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

1.6 QUALITY ASSURANCE

A. Comply with the following standards:

1. ACI 315. “Details and Detailing of Concrete Reinforcement”.
2. ACI 318. “Building Code Requirements for Reinforced Concrete”.

1.7 PRODUCT HANDLING

A. Delivery:

Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, length, and other information corresponding to markings shown on placement diagrams.
PART 2 PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: Comply with ASTM A 615, Grade 60.

B. Steel Wire: Comply with ASTM A 82.

C. Supports for reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:

1. Use wire bar type supports complying with ACI 315 recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
3. For exposed-to-view concrete surfaces, where legs of support are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

2.2 FABRICATION

A. General:

Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Unacceptable Materials:

Reinforcement with any of the following defects will not be permitted in the work:

1. Bar lengths, depths, and bends exceeding specified fabrication tolerances.
2. Bend or kinks not indicated on Drawings or final Shop Drawings.
3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the substrate, formwork, and the conditions under which concrete reinforcement is to be placed, and correct conditions which would prevent proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
3.2 INSTALLATION

A. General:
   1. Comply with the specified standards for details and methods of reinforcement placement and supports, and as herein specified.
   2. Clean reinforcement to remove loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
   3. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
   4. Place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
   5. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2 in. beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

B. Splices:
   Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 03 21 00.00 Add - REINFORCING STEEL FOR PAVEMENT AND UTILITIES

PART 1  GENERAL

1.1  SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes the furnishing and placing of reinforcing steel of the type, size, and quality designated for use in pavements and appurtenances thereof, as shown on the Drawings and in accordance with these Specifications.

1.2  RELATED SECTIONS

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3  REFERENCES

A. ASTM Designations A615  - Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement
C. ASTM A185  - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
D. ASTM A497 – Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
E. ASTM A82 - Standard Specifications for Cold Drawn Steel Wire for Concrete Reinforcement
F. ACI 318 – Building Code Requirements for Structural Concrete
G. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures
H. AWS D1.4 - Recommended Practices for Welding Reinforcing Steel

1.4  MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment will be made for Reinforcing Steel under this Section. Include payment in unit price items for which Reinforcing Steel is a component.

1.5  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Shop Drawings: The Contractor shall prepare, or cause to be prepared, and submit for approval complete detailed shop drawings of all reinforcing bars.
C. The Contractor shall furnish authentic, legible mill test reports for all reinforcing steel furnished on Port of Houston Authority work. Where such mill test reports are not available, the Port Construction Representative may order that such steel not be used on Port of Houston Authority work, or that testing be conducted by an independent testing laboratory selected by the Port Construction Representative. The Contractor shall be responsible for the cost of any such tests.

PART 2 PRODUCTS

2.1 Materials
A. Unless otherwise specified in the Technical Specifications or on the Drawings, all bar reinforcement shall be manufactured from billet steel bars conforming to the requirements of Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement (ASTM Designations A615). All bars, including stirrups, ties and hoops, shall be Grade 60. Plain bars and dowels shall conform to ASTM A675, Grade 60 and shall be subject to bench tests. Carbon content shall be limited to 0.60 percent maximum.

B. Welded wire fabric reinforcing shall conform to ASTM A185 for plain wire and ASTM A497 for deformed wire. Where not shown otherwise, fabric reinforcement shall be 6 x 6 - W 1.4 x W 1.4.

2.2 Quality Control
A. The Contractor shall furnish the Port Construction Representative with authentic, legible mill test reports for all reinforcing steel furnished on Port Authority work. Where such mill test reports are not available, the Port Construction Representative may order that such steel not be used on Port Authority work or that laboratory tests be made by a laboratory selected by the Port Construction Representative. The Contractor shall be responsible for the cost of any such tests.

B. Reinforcing steel delivered to the job site shall be tagged so as to identify the heat from which the bars were rolled. Material not so identified may be rejected.

PART 3 EXECUTION

3.1 Installation
A. Comply with specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports.

B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

3.2 Splices
A. Bars shall not be spliced at points of maximum stress, i.e., bottom bars at mid-span or top bars over supports. Splices other than those shown on the Drawings or noted in the Technical Specifications shall not be used unless approved through the submittal process.

B. Lap splices shall conform to ACI 318. Tension splices not at points of maximum stress shall be Class B.

C. Where welding of reinforcing steel is required this work shall be performed by experienced, certified welders in accordance with Recommended Practices for Welding Reinforcing Steel, AWS Designation D1.4. Prior to welding any reinforcing steel, the Contractor shall submit to the Port Construction Representative for approval, the
chemical composition of the reinforcements to be welded, the filler metal to be used, and proposed preheating and cooling procedures.

D. Splices in slabs shall be well distributed. Bars shall be rigidly clamped or wired together at all splices in a manner approved through the submittal process.

E. Unless otherwise shown on the Drawings, all the reinforcement in outer face of all corners of grade beams and spandrels shall be returned around corners or shall be provided with at least one No. 5 bent splice bar top and bottom. At ends of beams where they intersect cross beams or walls, at least No. 5 horizontal dowels shall be provided in the top and in the bottom. At corners of walls, all horizontal bars in the outer face shall be returned at corners, or bent dowels of equal size shall be provided. At the end of a wall where it intersects a cross wall, all horizontal bars shall be bent to lap with steel in the cross wall. Splices of all such dowels or of bars bent around corners shall be Class B, but not less than 12 inches.

F. Spiral reinforcement for columns shall be plain cold-drawn wire conforming to Standard Specifications for Cold Drawn Steel Wire for Concrete Reinforcement (ASTM Designation A82).

G. Welded wire fabric reinforcing shall conform to ASTM A185 for plain wire and ASTM A497 for deformed wire. Where not shown otherwise, fabric reinforcement shall be 6 x 6 - W 1.4 x W 1.4.

3.3 Fabrication

All details of fabrication not otherwise specified or shown on the Drawings shall be in accordance with latest edition of “Manual of Standard Practice for Detailing Reinforced Concrete Structures” of the American Concrete Institute (ACI 315).

3.4 Placing

A. Steel reinforcement at the time concrete is placed shall be free from all loose rust and scale, and oil or grease, dirt, concrete, or any other coating that will impair bond.

B. Steel reinforcement shall be placed accurately and adequately secured in position in the forms by metal chairs or spacers. The clear distance between bars, except in columns shall not be less than (a) the nominal diameter of the larger of two adjacent bars (b) 1-1/3 times the maximum size of coarse aggregate in the concrete, nor (c) one inch. Where reinforcement in beams is placed in two layers, the clear distance between layers shall be one inch, and the bars in the upper layers shall be directly above those in the bottom layer. The clear distance between bars shall apply to the clear distance between contact splices or bars.

C. Reinforcing steel in concrete columns and walls shall be held at the required distance from face of forms by approved spacers.

D. All reinforcing bars shall be tied together in the form. Two-way mats of steel shall be tied at alternate intersections both ways, except that in floor and pavement slabs that bear on ground or on flexible base, all bars shall be wired at every intersection.

E. Unless otherwise shown on the Drawings, steel in structural slabs that is transverse to main tension reinforcement shall be placed on top of the bottom layer and under the top layer of main reinforcement.

3.5 Bar Supports

A. Reinforcement in bottom of structural slabs and beams shall be supported on approved plastic, galvanized, or plastic tipped metal chairs. Plastic or plastic tipped chairs shall be used for soffits exposed to view. Use high chairs and bar raisers to support top bars of slabs and beams. All raisers in each line shall be continuous from side to side of the slab and shall be securely tied, with splices lapped 6 inches. Tie raiser bars to high chairs and tie top of each reinforcing bar to each raiser bar that it crosses.
B. Reinforcement in columns and walls that are formed shall be spaced at the correct distance from face of walls by approved plastic or galvanized metal spacers of approved design.

C. Galvanized wire for spacers and chairs shall not be smaller than No. 6 gauge. Lines of low chairs shall be spaced at four-foot centers maximum and each bottom bar shall be tied to each row of chairs that it crosses.

D. Reinforcement in drilled shafts, pipe piles, spread footings, and pavement slabs poured on ground, and on surfaces of walls and beams poured against earth, may be supported and spaced from sides either by plastic or galvanized metal supports and spacers of approved design or by concrete blocks. Blocks for supporting horizontal steel shall be 3” wide by 6” long and of such thickness as to support bars at the required elevation above bottom and below top of concrete. Blocks for spacing vertical steel from sides of columns and walls shall be 3” x 3” and of such thickness as will result in the cover of concrete over reinforcing steel shown on the Plans. Blocks shall have No. 16 gauge wire ties embedded in the face. Concrete roller spacers may be used in drilled shafts.

E. Space blocks 3 feet on centers each way and tie each block to principal reinforcement.

F. Contractor shall provide spacers between layers of bars in beams, and, where continuous top steel in beams is not required by the Drawings, shall provide ties of sufficient size to hold vertical stirrups in position. The Contractor shall provide any other accessories or tie bars necessary to hold the reinforcement rigidly in correct position.

3.6 Dowel Bars

Furnish and place dowel bars at pavement expansion, contraction, and construction joints, for roadway curbs, and at other locations, as detailed and specified on the Drawings or as prescribed elsewhere in the specifications.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 03 30 00.00 Add - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to General and Special Conditions, provide all cast-in-place concrete, in place, as indicated on the Drawings, specified herein, and needed for a complete and proper installation.

1.2 RELATED SECTIONS

A. 01 50 00.00 – Temporary Facilities and Controls Section
B. 03 10 00.00 – Concrete Formwork
C. 03 20 00.00 – Structural Concrete Reinforcement

1.3 REFERENCES

A. AASHTO M 182 – Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats
B. ACI 301 – Specifications for Structural Concrete
D. ACI 309 – Guide for Consolidation of Concrete
E. ASTM C 33 – Standard Specification for Concrete Aggregates
F. ASTM C94 – Standard Specification for Ready-Mixed Concrete
H. ASTM C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
J. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction
K. Corps of Engineers CRD-C 572 – Corps of Engineers Specifications for Polyvinyl Chloride Waterstops
L. Corps of Engineers CRD-C 621 – Corps of Engineers Specifications for Epoxy Grout
1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this section. Include price of cast-in-place concrete in the unit price of items for which cast-in-place concrete is a component.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Contractor shall submit Mill Certificates for bulk cement.

C. Design Mixes:

1. Submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ratio; compressive strength test results for 7 and 28 days; and shrinkage tests for Class C, D and E concrete at 21 or 28 days of drying.

2. Submit abrasion loss and soundness test results for limestone aggregate.

3. Testing of aggregates, including sieve analysis, shall be performed by a certified independent testing laboratory. Tests shall have been performed no earlier than 3 months before Notice to Proceed.

4. Provide standard deviation data for plant producing concrete. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 318, Item 5.3.1. Laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 318, Table 5.3.2.2.

5. Review and acceptance of mix design does not relieve Contractor of responsibility to provide concrete of quality and strength required by these Specifications.

D. Admixtures: Submit manufacturer's technical information, including following:

1. Air-Entraining Admixture: Give requirements to control air content under all conditions, including temperature variations and presence of other admixtures.

2. Chemical Admixtures: Give requirements for quantities and types to be used under various temperatures and job conditions to produce uniform, workable concrete mix. Submit evidence of compatibility with other admixtures and cementitious materials proposed for use in design mix.

E. High-range Water Reducer (Superplasticizer): When proposed for use, submit manufacturer's technical information and instructions for use of superplasticizer. State whether superplasticizer will be added at ready-mix plant or job site. When superplasticizer will be added at job site, submit proposed plan for measuring and adding superplasticizer to concrete mix at job site, and establish dosing area on site with holding tanks and metering devices. When superplasticizer is to be added at ready-mix plant, submit contingency plans for adding additional superplasticizer at job site when required due to delay in placing concrete. Identify portions of Work on which superplasticizer is proposed for use.

F. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and cold weather concreting. Review and acceptance of proposed procedure will not relieve Contractor of responsibility for quality of finished product.
G. Project Record Drawings: Accurately record actual locations of embedded utilities and components which are concealed from view.

1.6 STORAGE OF MATERIALS

A. Cement shall be stored in weather tight buildings, bins, or silos which will exclude moisture and contaminants.

B. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. To ensure that this condition is met, any test for determining conformance to requirements for cleanliness and grading shall be performed on samples secured from the aggregates at the point of batching. Frozen or partially frozen aggregates shall not be used.

C. Natural or manufactured sand shall be allowed to drain until it has reached relatively uniform moisture content before it is used.

D. Admixtures shall be stored in such a manner as to avoid contamination, evaporation, or damage. For those used in the form of suspensions or non-stable solutions, agitating equipment shall be provided to assure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Contractor shall comply with standards for air quality or air emissions associated with concrete production during construction.

1.8 QUALITY ASSURANCE

A. Standards

1. Comply with standards specified in this Section.

2. In case of conflict between the referenced standards, the more stringent requirements shall govern.

B. Qualifications of Installers

1. Throughout the progress of installation of the work of this Section, provide at least one person who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, and who shall be present at the site and shall direct all work performed under this Section.

2. In actual installation of the work of this Section, use adequate numbers of skilled workmen to ensure installation in strict accordance with the approved design.

3. In acceptance or rejection of work performed under this Section, the Port Authority will make no allowance for lack of skill on the part of workmen.

C. Quality Control

1. Prior to all work under this Section, make all necessary arrangements with the testing laboratory. The Contractor shall:

   a. Furnish certified reports of each proposed mix for each type of concrete prior to start of installation of the work of this Section.
1.9 PRODUCT HANDLING

A. Protection

Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Port Construction Representative and at Contractor's own expense.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: Portland cement shall conform to the requirements of "Standard Specification for Portland Cement," ASTM Designation C150, for either Type I or Type II cement. Type III shall be used only when approved by the Port Construction Representative. Type III cement will not be permitted in structures constructed in or above the water or in portions of structures below ground.

B. Aggregate: Fine and coarse aggregate shall comply with the requirements of Specifications for Concrete Aggregate, ASTM Designation C33.

C. Water: Mixing water for concrete shall be fresh, clean and potable. The Contractor is responsible for supplying water for construction in accordance with Section 01 50 00.00 - Temporary Facilities and Controls.

D. Admixtures:

1. Air Entrainment: An approved brand of air entraining agent conforming to "Specifications for Air-Entraining Admixtures for Concrete," ASTM C260 shall be used with all concrete. It shall be introduced in the mixture at the mixer in such quantities as to provide not more than five percent nor less than three percent entrained air as determined by tests performed in accordance with ASTM C138. Entrained air in concrete floor slabs shall not exceed 4.5 percent.

2. Water-Reducing, Retarding and Accelerating Admixtures:
   a. Water-reducing, retarding and accelerating admixtures shall conform to the requirements of "Specifications for Chemical Admixtures for Concrete," ASTM C494. Acceptable manufacturers are:
      1) W. R. Grace and Co.
      2) BASF
      3) Sika Chemical Co.
      4) Fox Industries, Inc.
   b. Products of other manufacturers may be submitted for approval. No admixture containing calcium chloride as a functional ingredient may be used at any time.
   c. The manufacturer shall submit a statement of conformance to ASTM C494, including test results. In addition, the manufacturer shall state, in writing, the chloride content of the admixture and whether or not chloride has been added during its manufacture.

2.2 FORM MATERIALS See Section 03 10 00.00 – Concrete Formwork
2.3 CLASSIFICATION

The Drawings and/or the Technical Specifications for each item of work indicate the class of concrete to be used for each element of the work. Each class of concrete shall meet the requirements tabulated below:

<table>
<thead>
<tr>
<th>Class</th>
<th>Minimum Compressive Strength (at 28 Days)</th>
<th>Aggregate Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3000</td>
<td>1-1/2&quot; to No. 4</td>
</tr>
<tr>
<td>B</td>
<td>3000</td>
<td>1&quot; to No. 4</td>
</tr>
<tr>
<td>C</td>
<td>3000</td>
<td>3/4&quot; to No. 4</td>
</tr>
<tr>
<td>D</td>
<td>4000</td>
<td>1-1/2&quot; to No. 4</td>
</tr>
<tr>
<td>E</td>
<td>4000</td>
<td>1&quot; to No. 4</td>
</tr>
<tr>
<td>F</td>
<td>4000</td>
<td>3/4&quot; to No. 4</td>
</tr>
<tr>
<td>G</td>
<td>5000</td>
<td>1-1/2&quot; to No. 4</td>
</tr>
<tr>
<td>H</td>
<td>5000</td>
<td>1&quot; to No. 4</td>
</tr>
<tr>
<td>I</td>
<td>5000</td>
<td>3/4&quot; to No. 4</td>
</tr>
<tr>
<td>J</td>
<td>2500</td>
<td>1-1/2&quot; to No. 4</td>
</tr>
<tr>
<td>K</td>
<td>2500</td>
<td>3/4&quot; to No. 4</td>
</tr>
<tr>
<td></td>
<td>Minimum Compressive Strength (at 7 Days)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>1670</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>1670</td>
<td></td>
</tr>
</tbody>
</table>

2.4 PROPORTIONING OF CONCRETE

A. The concrete shall be composed of Portland cement, coarse aggregate, fine aggregate, approved admixtures and water. Concrete shall meet all requirements herein for strength, cement content, water-cement ratio, slump, etc. Concrete shall have adequate workability and proper consistency to be worked readily into the forms and around reinforcement under the conditions of placement to be employed without excessive segregation or bleeding.

B. Proportions shall be established by the Contractor and submitted to the Port Construction Representative for verification by a testing laboratory selected by the Port Construction Representative. Mix design shall be based on the procedures of ACI 318, "Building Code Requirements for Reinforced Concrete." Proportions may be established on the basis of field experience with the materials to be employed or on the basis of laboratory trial batches.

C. Where mix design is based on trial batches, the Contractor, at least ten days prior to placing concrete, shall submit a mix design and samples of all concrete materials to the Port Construction Representative. The laboratory will make up at least two batches of each class of concrete using the proportions of materials as submitted. A minimum of four standard size cylinders from each batch shall be molded, properly cured, and tested for seven-day compressive strengths as outlined in the latest ASTM test standards. If these cylinders fail to meet the required breaking strength, the mix shall be redesigned and more batches and specimens made and tested as above. This procedure shall be repeated until a satisfactory batch design has been determined. After the mix proportions and water-cement ratio required to produce the given strength have been determined, the Contractor may begin
placing the concrete. The mix shall be redesigned during the job as may be necessary to obtain the specified strength, or if a change in materials is desired, in the same manner as outlined for the initial design.

D. Where mix design is based on prior performance record, the laboratory will verify the experience required by ACI 318 and that those materials and proportions to be furnished are the same as those on which experience records are based.

E. Cement content shall be based on the following water cement ratios, except that minimum cement content shall be five (5) sacks per cubic yard:

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Max. Water-Cement Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structures constructed in, above or immediately adjacent to the water; other structures exposed to the action of water</td>
<td>0.44</td>
</tr>
<tr>
<td>Thin sections in air or not exposed to water such as pipe piles, ledges, railing and curbs; pavement</td>
<td>0.53</td>
</tr>
<tr>
<td>Moderate sections, such as retaining walls, abutments, piers, girders and beams; concrete requirements protected from weather or below ground</td>
<td>Determined by strength requirements</td>
</tr>
</tbody>
</table>

F. Unless indicated otherwise on the Drawings, Technical Specifications or other Specifications, the maximum slump shall be four inches (4"). Higher slumps may be approved by the Port Construction Representative if achieved without detrimental effects to the concrete.

G. Maximum Size of Coarse Aggregate: The nominal maximum size of the aggregate shall not be more than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between reinforcing bars. These limitations may be waived if, in the judgment of the Port Construction Representative, workability and methods of consolidation are such that the concrete can be placed without honeycomb or voids.

H. Use of Admixtures:

1. Water-reducing admixtures may be added to improve workability or reduce the amount of water required for hydration.
2. All concrete placed in slabs when the ambient temperature is 85 degrees F., or higher, shall contain a set-retarding admixture.
3. Amounts of admixtures to be added to the mix shall be in accordance with the manufacturer's instructions to achieve the desired results.

2.5 OTHER MATERIALS

A. Expansion Joint Filler:

Preformed expansion joint filler material shall be bituminous fiber type conforming to ASTM D 1751.

B. Hydrophilic Expansion Rubber Waterstops

1. Minimum swelling ratio shall be 1.7 times the original volume.
2. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include but are not limited to the following:
a. Synko-Flex

C. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572

Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include but are not limited to the following:

1. AFCO Products
2. The Burke Co.
3. Edoco Technical Products
4. Greensheet Plastic Products
5. Harbour Town Products
6. W.R. Meadows
7. Progress Unlimited
8. Schleigel Corp.
9. Vinylex Corp.

D. Non-Shrink Grout: CRD-C 621, factory pre-mixed grout

Product: Subject to compliance with requirements, products which may be incorporated in the work include but are not limited to the following:

1. Metallic:
   a. "Viborfoil"; A.C. Horn
   b. "Metallic Sepc, Grout"; The Burke Co.
   c. "Embeco 636"; Master Builders
   d. "Ferrolith G"; Sonneborn-Contech
   e. "Firmix"; Euclid Chemical Co.
   f. "Kemox G"; Sika Chemical Co.
   g. Ferrogrout"; L & M Const. Chemical Co.

2. Non-Metallic:
   a. "Masterflow 713"; Master Builders
   b. "Sonogrout"; Sonneborn-Contech
   c. "Euco-NS"; Euclid Chemical Co.
   d. "Crystex"; L & M Const. Chemical Co.
   e. "Sure-Grip Grout"; Dayton Superior Corp.
   f. "Horngrouit"; A.C. Horn

E. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.

1. Product: Subject to compliance with requirements, products which may be incorporated in the work include but are not limited to the following:
   a. "SCB Structural Concrete Bonding"; Master Builders
   b. "Epoxitite"; A.C. Horn
   d. "Sikadur Hi-Mod"; Sika Chemical Corp.
   e. "Euco Epoxy 463 or 615"; Euclid Chemical Co.
   f. "Patch and Bond Epoxy"; The Burke Co.
   g. "Sure-Pox"; Kaufmann Products, Inc.
2.6 BATCHING, MIXING, AND DELIVERY EQUIPMENT

Use transit-mixed concrete from approved batching and mixing plant. Batch, mix, and transport concrete to site in accordance with provisions of ASTM C 94.

PART 3 CONCRETE PLACEMENT

3.1 INSPECTION

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 EXECUTION

A. General: Place concrete in compliance with practices and recommendations of ACI 304, and as herein specified.

B. Procedures

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.
2. If a section cannot be placed continuously, provide construction joints as herein specified.
3. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.
4. Deposit concrete as nearly as practicable in its final location to avoid segregation due to re-handling and flowing.
5. Do not subject concrete to any procedure which will cause segregation.
6. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming and grouting.
7. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials.
8. Remove rejected concrete from the site and dispose of it in a location approved by the Port Construction Representative for that purpose.

C. Placement Schedule

Place concrete in conformance with the placement schedule to ensure an even distribution of loads throughout the entire structure.

1. Concrete Conveying

   a. Handle concrete from the point of delivery and transfer to the concrete conveying equipment, and to the locations of final deposit, as rapidly as practicable and by methods which will prevent segregation and loss of concrete mix materials.
   b. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit.
   c. Keep interior surfaces of conveying equipment, including chutes and tremies, free from hardened concrete, debris, water, and other deleterious materials.
   d. Pumps may be used only if they can pump the mix designed. Do not add fine aggregate or water to the mix to satisfy needs of a pumping device.
e. Use chutes or tremies for placing concrete where a drop of more than 72 in. is required.
f. Where free drop through tremies exceeds 18 ft.-0 in., use flow checking devices.

2. Placing Concrete in Forms

   a. Deposit concrete in forms in horizontal layers not deeper than 24 in., and to avoid inclined construction joints.
   b. Where placement consists of several layers, place each layer while preceding layer is still plastic and to avoid cold joints.
   c. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
   d. Do not place concrete in supporting element until the concrete previously placed in columns and walls is no longer plastic.

3. Placing Concrete Slabs

   a. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
   b. Consolidate concrete during placement by use of the specified equipment, thoroughly working concrete around the reinforcement and into corners.
   c. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on grade, as specified in formed concrete structures.
   d. Consolidate concrete in remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other methods acceptable to the Port Authority.
   e. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.
   f. Bring slab surfaces to the correct level with a straight edge, and then strike off.
   g. Use bull floats or darbies to smooth the surface, leaving it free from bumps and hollows.
   h. Do not sprinkle water on the plastic surface; do not disturb the slab surfaces prior to start of finishing operations.

4. Cold Weather Placing

   Comply with ACI 306 to protect all concrete work from physical damage and reduced strength which would be caused by frost, freezing actions, or low temperatures.

5. Hot Weather Placing

   When hot weather conditions exist, (which would seriously impair the quality and strength of concrete), place the concrete as follows:

   a. Maintain concrete temperature at time of placement below 90 degrees F. Use chilled mixing water or chopped ice to control concrete temperature, provided the water equivalent of the ice is calculated to the total amount of water.
   b. Cover reinforcing steel with water-soaked burlap if the steel becomes too hot. Steel temperature shall not exceed the ambient air temperature immediately prior to placement of concrete.
   c. Wet forms thoroughly prior to placement of concrete.
   d. Use set-control admixtures in the mix.
3.3 CONSOLIDATION

A. General

1. Consolidate all concrete in accordance with provisions of ACI 309.
2. Consolidate each layer of concrete immediately after placing, by use of internal concrete vibrators supplemented by hand-spading, rodding, or tamping.
3. Do not use vibrators to transport concrete inside the forms.
4. During all phases of operation, maintain a frequency of not less than 10,000 vibrations per minute per internal vibrator.
5. Do not vibrate forms or reinforcement.

B. Equipment

1. Provide adequate number of units and power source at all times. Maintain spare units on hand to ensure adequacy.
2. If, in the opinion of the Port Authority, the equipment being used is not adequate to accomplish proper consolidation, the Port Authority may order delay in further placement of concrete until such equipment is available for use at the location of placement of concrete.

C. Procedures

1. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation of aggregates.
2. Insert the vibrator so as to penetrate the lift immediately below the one being placed, and manipulate to blend the two lifts.
3. Do not insert the vibrator into lower courses which have begun to set.
4. Use the vibrator to melt down the concrete as it is being placed, and use the vibrator to consolidate the mass of concrete.
5. In the case of wall construction, assign at least one vibrator and vibrator-operator to melting down the mix; and assign at least one vibrator and vibrator-operator to consolidating the mass of concrete.
6. Spacing between insertions of the vibrator which is used to consolidate shall not exceed twice the radius of action as shown in table 5.1.4 of ACI 309.
7. Under no circumstances shall the points of insertion during the consolidation phase be more than 18 in. apart.

D. The Contractor shall have spare vibrators at the job site during the concrete placement period.

3.4 CONCRETE FINISHING

A. Finish of Formed Surfaces

1. Rough form finish:
   a. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by any other construction.
   b. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched, and all fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.
2. Smooth form finish:
   a. Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view, or that are to be covered with a coating material other than cement plaster applied directly to the concrete.
   b. Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams.
   c. Repair and patch defective areas with all fins and other projections completely removed and smoothed.

3. Related unformed surfaces:
   a. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a smooth trowel finish.

B. Monolithic Slab Finishes

1. Nonslip bloom finish:
   a. Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as shown on the Drawings or in the schedules.
   b. Immediately after trowel finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use a fiber bristle broom.
   c. Coordinate the required finish with the Port Construction Representative prior to application.

3.5 MISCELLANEOUS CONCRETE ITEMS

A. Filling In

Fill in holes and openings left in concrete structures for the passage of work of other trades, unless otherwise directed, after the work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling to complete the work

B. Equipment Bases and Foundations

Provide machine and equipment bases and foundations as shown on the Drawings or required for the machine and equipment actually furnished. Set anchor bolts for machines and equipment to template, at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment. Provide isolation joints surrounding bases where indicated or required.

C. Construction Joints

1. Joints not shown in the Contract Documents shall be so made and located as to least impair the strength of the structure and shall be approved. In general, they shall be located near the middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.
2. All reinforcement shall be continued across joints. Keys and dowels shall be provided as directed by the Port Construction Representative. Longitudinal keys at least 1-1/2 in. deep and one-third the width of the member shall be provided in all joints in walls and between walls and slabs or footings. Slab joints shall also be keyed.

3. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed prior to placing adjoining concrete.

4. When required or permitted, bond shall be obtained by the use of an approved adhesive or by roughening the surface of the concrete to expose the aggregate and remove laitance or damaged concrete.

D. Expansion Joints

1. Reinforcement or other embedded metal items bonded to the concrete (except dowels bonded on only one side of joints) shall not be permitted to extend continuously through any expansion joint.

2. Premolded expansion joint filler shall be of the type required by the Technical Specifications and shall conform to one of the following.

   c. Unless specified in more detail in the Technical Specifications or on the Drawings, joint sealer shall conform to ASTM D1190. Joint sealer shall be compatible with the joint filler specified.

3.6 REMEDIAL WORK

A. General

Reinforce or replace deficient work as directed by the Port Construction Representative and at Contractor's own expense.

B. Patching

Repair defective areas and fill form-tie holes and similar defects in accordance with Chapter 9 of ACI 301. Where, in the opinion of the Port Authority, surface defects such as honeycomb occur, repair the defective areas as directed by the Port Construction Representative.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 03 62 13.00 Add - NON-SHRINK GROUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes the requirements for nonmetallic non-shrink grout for leveling column base plates, steel beams bearing on concrete, precast beams and panels, machinery and other equipment, for anchoring handrail posts into sleeves embedded in concrete, and at all other locations shown or reasonably implied by the Drawings.

1.2 RELATED SECTIONS

A. 03 30 00.00 – Cast-in-Place Concrete

1.3 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates


1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment will be made for non-shrink grout under this Section. Include payment in unit price of items for which non-shrink grout is a component.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Acceptable brands of materials are specified herein. If substitutions are proposed by the Contractor, submit the following information on the proposed substitution for approval before delivery to the project:

1. Manufacturer's technical literature including manufacturer's specifications for mixing and placing of the grout.

2. Results of tests performed by a certified independent testing laboratory showing conformance to ASTM C 1107 and the requirements of this specification.

3. Provide test data from an independent laboratory indicating that the grout, when placed at a fluid consistency, will achieve 95 percent bearing under a 4-foot by 4-foot base plate.
1.6 MANUFACTURER'S ASSISTANCE

A. Manufacturers of proprietary products shall make available, at no cost and upon 72 hours' notification, the services of a qualified, full-time employee to aid in assuring proper use of the product under job conditions.

1.7 DELIVERY AND STORAGE

A. Non-shrink grout shall be delivered to the project in unopened containers and shall bear intact manufacturer's labels.

B. Store all non-shrink grout material in dry shelter and protect from moisture.

C. Containers that are torn or damaged such that the non-shrink grout material has been exposed to the elements shall be discarded.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The following are known acceptable manufacturers to supply the product required by this Section.

1. Euclid.
2. Master Builds.
3. Five Star Grout.
4. Or approved substitution.

2.2 NON-SHRINK GROUT

A. Grout shall contain nonmetallic natural aggregate and shall be nonstaining and noncorrosive. Grout shall be pre-blended factory-packaged material manufactured, under rigid quality control, specifically for use in transferring heavy loads. The non-shrink grout shall conform to the following requirements:

1. ASTM C 1107, Grade C.
2. Resist attack by oil and water.
3. Have minimum initial setting time of approximately 1 hour at 70 F.
4. Have a minimum compressive strength in the fluid consistency of 6500 psi at 28 days.
5. Shall not contain any chlorides or additives which may contribute to corrosion.
6. Shall be non-bleeding and non-segregating at a fluid consistency.
7. Provide total shrinkage compensation which provides a maximum bearing surface for the greatest overall support.

2.3 WATER

A. Water used for mixing the grout shall be potable.
2.4 PEA GRAVEL
A. Clean pea gravel conforming to ASTM C 33 coarse aggregate graded so that at least 90 percent passes a 3/8-inch sieve and 90 percent is retained by a No. 4 sieve.

2.5 MEMBRANE-FORMING CURING COMPOUND
A. Conform to the requirements of Section 03 30 00.00, Cast-in-Place Concrete.

2.6 CELLULAR GROUT
A. Cellular grout shall have a 28 day compressive strength of 3000 psi.

PART 3 EXECUTION

3.1 PROCEDURES
A. Installation methods and procedures shall conform to the printed instructions of the grout manufacturer and these specifications. Where there is a conflict between these specifications and the printed instructions of the grout manufacturer, the printed instructions of the grout manufacturer shall take precedence.

3.2 PREPARATION
A. Remove all defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping or other similar means, until a sound, clean concrete surface is achieved.
B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
C. Remove foreign materials from all surfaces in contact with grout.
D. Align, level and maintain final positioning of all components to be grouted. Coat shim with a thin film of grease or wax to facilitate removal.
E. Provide relief holes to avoid trapping air beneath the base plate.
F. Take special precautions during extreme weather conditions according to the manufacturer's written instructions.
G. Saturate all concrete surfaces with clean water for the period of time specified by the manufacturer. Remove excess water and leave none standing.
H. Immediately before grouting, clean any contaminated surfaces.

3.3 FORMWORK
A. Build leakproof forms that are strong and securely anchored and shored to withstand grout pressures. Forms shall be built high enough to provide a "head" of grout where it is required to force grout into difficult locations.
B. Provide enough clearance between the formwork and the area to be grouted to permit proper placement of grout.

3.4 MIXES

A. For less than a 4-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of grout material and water.

B. For greater than 4-inch clearances where coarse aggregate will not obstruct free passage of the grout, the grout may be extended by adding clean pea gravel if allowed or recommended by the grout manufacturer. Follow the manufacturer's recommendation for the maximum amount of pea gravel that may be added.

C. Use the minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

3.5 MIXING

A. Mixing of non-shrink grout shall be in strict conformance to the recommendations of the grout manufacturer.

B. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

3.6 PLACING

A. Place non-shrink grouting material quickly and continuously by the most practical means permissible: pouring, pumping or under gravity pressure. Do not use either pneumatic-pressure or dry packing methods without written permission of the Port Construction Representative.

B. Follow established concreting procedures observing precautions for hot and cold weather concreting.

C. When practical, apply grout from one side only to avoid entrapping air.

D. Final installation shall be thoroughly compacted and free from air pockets. To facilitate placement, a 1/2- to 1-inch chain or metal strap may be pulled back and forth under the equipment during grouting. Remove chain or strap before initial set takes place.

E. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment, except when approved by the grout manufacturer.

F. Do not remove leveling shims for at least 48 hours after grout has been placed. After shims have been removed, fill voids with non-shrink grout.

3.7 CURING

A. Cure grout for 3 days after placing by keeping wet and covering with curing paper, by coating with a concrete membrane-forming curing compound, or by other approved method.
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SECTION 05 50 00.01 Add - MISCELLANEOUS METALS

PART 1    GENERAL

1.1    SECTION INCLUDES

A. Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, materials, equipment, supervision, and other things necessary to provide all miscellaneous metal work, including but not limited to: Pipe Sleeves, Angle Frames for manholes, inlets, vaults, trenches or other openings, Expansion Joint Armoring, Floor Plates, Mooring Devices and other Metal Constructions of a nature similar to those above as described and specified herein and as shown on the Drawings, or otherwise required to complete the work.

1.2    RELATED SECTIONS

A. SECTION 01 22 10.00 Std – Measurement of Quantities
B. SECTION 05 12 00.00 Std – Structural Steel Framing
C. SECTION 09 96 00.00 Std – High Performance Coatings
D. SECTION 09 96 00.13 Std – Crane Painting

1.3    REFERENCES

A. ASTM International Publications, latest editions:

   ASTM A-36 Standard Specification for Carbon Structural Steel
   ASTM A-53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   ASTM A-153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   ASTM A-240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A-269  Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service


ASTM A-434  Standard Specification for Steel Bars, Alloy, Hot-Wrought or Cold-Finished, Quenched and Tempered

ASTM A-489  Standard Specification for Carbon Steel Lifting Eyes

ASTM A-501  Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

ASTM A-511  Standard Specification for Seamless Stainless Steel Mechanical Tubing

ASTM A-653  Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM F-593  Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

ASTM F-594  Standard Specification for Stainless Steel Nuts

B. American Society of Mechanical Engineers (ASME) Publications, latest editions:
   B18.21.1  Lock Washers (Inch Series)
   B18.22.1  Plain Washers

C. American Welding Society (AWS) Designation
   A 5.1  Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

1.4 SUBMITTALS

A. Product Data and shop drawings for: Steel, pipes, plates, shapes, tubing, bars, bolts, rods and nuts, electrodes, sleeves, and anchors.

B. Samples
1.5 HANDLING AND STORAGE

NOT USED

1.6 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made to work under this section. Include price of concrete reinforcement in the unit price of items for which concrete reinforcement is a component.

PART 2 PRODUCTS

2.1 CARBON STEEL

Steel shapes, plates and rods shall comply with the Standard Specifications for Carbon Structural Steel, ASTM A-36.

Steel pipe, including guard posts, bollards and railing, shall conform to the requirements of Standard Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless, ASTM A-53, for Type E, Grade B, or for Type S, Grade B. Carbon steel pipe made under other ASTM Specifications will be acceptable provided the yield point of the steel is not less than 35,000 psi and the ultimate strength not less than 60,000 psi.

Round, square or rectangular steel tubing shall conform to Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing, ASTM A-501.

Rolled-Steel Floor Plate:  ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

No carbon steel shapes, plates, pipe, tubing, bars, or rods shall be used in work governed by this Technical Specification that has become rusted and pitted to a degree more severe than that defined by "Pictorial Surface Preparation Standards for Painting Steel Structures" (Designation SSPC-Vis-1 of the Steel Structures Painting Council) as Condition "B". When the surface is more severely corroded than that defined as Condition "B", the Inspector may require a higher grade of surface preparation than is set out herein or in 1.2 Related Sections prior to applying shop coating.

2.2 STAINLESS STEEL

Stainless Steel Plates and sheets shall conform to the requirements of Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels, ASTM A-240, for Type 302 or 304 alloy.

Stainless Steel Pipe and Tubing shall be of the size called for on the Drawings or in the Technical Specifications and shall conform to the requirements of Specification for Seamless and Welded Austenitic Stainless Steel Tubing, for General Service, ASTM A-269, for Type 304 alloy.

Stainless Steel Square and rectangular tubing shall conform to the requirements of Specification for Seamless Stainless Steel Mechanical Tubing, ASTM A-511, for Type 302 or 304 alloys.
2.3 BOLTS, RODS AND NUTS

Common bolts, threaded rods, rod braces, sag rods, and nuts or other similar threaded parts shall conform to the requirements of Standard Specification for “Carbon Steel, Bolts and Studs, 60,000 PSI Tensile” ASTM A-307 for Grade A bolts. Bolt heads and nuts shall be provided with standard cut washers. Bolts, rods, nuts, and washers used for fastening galvanized steel parts or for fastening parts required to be coated with organic or inorganic zinc coating material shall be galvanized. Threads in nuts shall be cut to allow for thickness of zinc coating. Bent anchor rods shall be hot-forged in the plastic ranges of temperatures to the shape shown on the Drawings.


Eyebolts: ASTM A 489.


2.4 ARC-WELDING ELECTRODES

Electrodes for arc-welding structural steel plates and shapes shall conform to the requirements of Specification for Mild Steel Arc-Welding Electrodes AWS Specification A5.1 for E6010, E6011, or E6012 electrodes, and shall be suitable for the positions of the welds and the type and polarity of the current used. For A-36 steel one inch or more in thickness, only the E70 series of electrodes shall be used.

Electrodes for welding stainless steel shall conform to the requirements of Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes, AWS Specifications A5.4 Class E308L rods will be used for welding stainless steel to stainless steel. Class E309 rods shall be used to weld stainless steel to carbon steel. Welding rods shall be suitable for the position of the weld and the type and polarity of current used.

2.5 PIPE SLEEVES

Pipe for sleeves shall comply with Standard Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless (ASTM A-53). Pipe to be inserted in concrete, and pipe for the other purposes designated to be galvanized, shall be galvanized in accordance with the paragraph cited above.
2.6 MOORING DEVICES

Cast steel mooring cleats, kevels, bollards, and other mooring attachments shall conform to Standard Specifications for Steel Castings High-Strength for Structural Purposes (ASTM A-148) for Grade 80-50 Cast Steel. Mooring Devices shall be made to the pattern shown on the Drawings.

2.7 GALVANIZING REPAIR COMPOUND

Galvanizing compound for repairs to damaged zinc coating shall be a cold-applied compound, ZRC Cold Galvanizing Compound as manufactured by ZRC Worldwide, Marshfield, MA, 1-800831-3275, or approved equal.

2.8 SHOP PAINT

Coating to be applied under these specifications shall be as specified in Sections found in Division 9.

2.9 OTHER MISCELLANEOUS METALS

Miscellaneous metals not specified herein shall be furnished to details shown on the Drawings and to the provisions of the Related Sections.

2.10 GALVANIZING

A. All miscellaneous iron and steel items to be installed in concrete, except those required to be of stainless steel, and all items specified in the Related Sections to be galvanized shall be zinc coated in accordance with the applicable specification of the American Society for Testing and Materials set out below. All cutting, welding, threading, or other shop operations except machining of bearing surfaces of moving parts shall be completed before the item is galvanized.

B. Cast iron, malleable iron, and cast steel parts, all rolled, pressed or forged articles, and all rods, nuts, bolts, washers, rivets and similar items required to be galvanized, shall be coated in accordance with Standard Specification for Zinc Coating (Hot-Dip Galvanized) on Iron and Steel Hardware (ASTM A-153).

C. Fabricated welded construction of rolled, pressed, or forged steel shapes, plates, bars or sheets, including steel gratings, when required to be galvanized shall be coated after fabrication is complete in accordance with Standard Specifications for Zinc Coatings (Hot-Dipped Galvanized) on Iron and Steel Products (ASTM A-123).

D. Steel sheet required to be galvanized, but not to be welded or flame-cut, shall conform to the requirements of Standard Specifications for Steel Sheet Zinc Coated (Galvanized) by the Hot-Dipped Process Structural (Physical Quality), (ASTM A-446) for Grade A Sheets with a 2-Ounce Coating.
E. All galvanized surfaces that have become damaged during shipping, handling, erection, or installation, or that have been burned by welding or flame-cutting, or damaged in any other way, shall be repaired with a cold-applied galvanizing compound conforming to this Section applied in strict compliance with the manufacturer's specifications.

PART 3 EXECUTION

3.1 FABRICATION

A. Workmanship:

All cuts shall be sheared or flame-cut with automatic, guided equipment. Edges cut with a hand torch shall be ground neat, smooth, and straight. All edges shall be ground free of sharp edges, burrs, and weld splatters. All fits shall be accurate.

B. Bolt Holes:

Bolt holes shall be punched, drilled, or sub-punched and reamed. If holes are flame-cut they shall be burned undersize and reamed to correct size.

C. Welding:

All welding shall be performed in accordance with the provisions of Code for Welding in Building Construction (AWS Designation D1.1). Multipass welds for stainless steel shall be chipped or ground completely free of slag between passes. All welds shall be of uniform quality. Butt welds shall be continuous. Edges of faying surfaces of lapped joints shall be continuously seal welded in addition to welding required for strength.

END OF SECTION
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SECTION 09 91 00.00 Add – PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes:

1. Surface preparation and field painting application.
2. Shop preparation and shop prime coating when specified in other Sections of these Specifications.
3. Preparing surfaces, providing adequate conditions for proper workmanship, and furnishing and applying the protective coating materials required for metallic and plastic surfaces.
4. A free choice of manufacturer's standard factory mixed or mechanically proportioned intermixed colors. A color schedule will be furnished after manufacturer of material has been selected.
5. Color code painting of piping and piping identification signs and markers.

1.2 RELATED SECTIONS

A. The requirements of Division 01 and General and Special Conditions of the contract apply to this work.

1.3 REFERENCES

A. ASTM D16 - Definitions of Terms Rating to Paint, Varnish, Lacquer, and Related Products.
C. Painting and Decorating Contractors of America (PDCA) - Painting - Architectural Specifications Manual.

1.4 MEASUREMENT AND PAYMENT

A. No separate payment will be made for painting and coatings under this Section. Include payment in unit price of items for which painting and coatings shall be applied.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Product Data: Provide data on all finishing products.

C. Inspection Devices: Furnish inspection devices, in good working conditions for the detection of holidays, and the measurement of coating thickness (wet and dry).

D. Provide mask, gloves and other protective materials, and/or clothing recommended by the paint manufacturer.

E. Provide special, temporary ventilation required by the paint manufacturer.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of General and Special Conditions.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F in ventilated area, and as required by manufacturer's instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not apply material when surface and ambient temperature are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperature for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

E. Paint products containing lead are not permitted.

F. Contractor shall have Material Safety Data Sheets (MSDS) on site for all materials.

G. Contractor shall place any possible pollutants in containment berm to prevent contaminated runoff.

H. Contractor shall develop a spill plan and comply with the Good Housekeeping Practices outlined in the Project Storm Water Pollution Prevention Plan.
1.9 EXTRA MATERIALS

A. Provide 3 gallons of each color of each coating of material specified for maintenance use. Provide in individual gallon quantities.

B. Label each container with manufacturer's name, product number, color number, date and name and number of building rooms where used, equipment or piping coated, etc.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. See Schedule in Part 3 for manufacturers, types, surfaces by exposure to be painted, the paint system to use and minimum dry mil thickness.

B. The following manufacturers (with the abbreviated name used in the Painting Schedule) are approved for use. Use the products of only one manufacturer.

1. Devoe & Reynolds Co. (Devoe).
2. Pittsburgh Paints, (PPG).
4. The Valspar Corporation, (Valspar).
5. The Sherwin Williams Co., (Sherwin).

C. Products of a manufacturer other than those named may be accepted if proof is submitted, prepared by an independent testing laboratory that the products, item by item, are the same generic type and comparable to those specified in composition, durability, utility, coverage, and appearance for the intended use.

2.2 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions.

B. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Starting work constitutes acceptance (on the Contractor's part) of conditions and substrates and full responsibilities for the quality and suitable for the finished work.

3.2 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

C. Seal with shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand surfaces required lightly between coats to achieve required finish.

F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

G. Allow applied coat to dry before next coat is applied.

H. Prime concealed surfaces of interior and exterior woodwork with primer paint.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01450 - Contractor's Quality Control.
B. Test questionable coated areas.

3.5 CLEANING

A. Clean work under provisions of the General and Special Conditions.

B. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 SCHEDULE COLORS

A. The Port Construction Representative will prepare color schedule after award of Contract.

END OF SECTION
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SECTION 09 91 01.00 Add – PROTECTIVE COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes:

1. Preparing surfaces, providing adequate conditions for proper workmanship, and furnishing and applying the protective coating materials required for metallic and plastic surfaces.
2. Color code painting of piping and piping identification signs and markers.

1.2 RELATED SECTIONS

A. The requirements of Division 01 and General and Special Conditions of the contract apply to this work.

1.3 REFERENCES

E. SSPC-PA1 - Paint Application Specification No. 1.
F. SSPC-PA2 - Paint Application Specification No. 2.
G. SSPC-SP1 - Solvent Cleaning.
H. SSPC-SP2 - Hand Tool Cleaning.
I. SSPC-SP3 - Power Tool Cleaning.
J. SSPC-SP5 - White Metal Blast Cleaning.
K. SSPC-SP6 - Commercial Blast Cleaning.
L. SSPC-SP7 - Brush-off Blast Cleaning.
M. SSPC-SP10 - Near-white Blast Cleaning.
1.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this Section. Include cost of protective coatings in the unit price of associated items for this project.

1.5 DEFINITIONS

A. Paint, coatings, or finishes as used in this Section include surface treatments, emulsions, enamels, paints, epoxy resins, and other protective coatings, with the exceptions of galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

B. DFT means minimum dry film thickness.

1.6 PERFORMANCE REQUIREMENTS

A. See the Drawings and other Specifications to determine the locations at which coatings under this Section will be applied. Paint or coat new and modified surfaces in conformance with this Section.

B. Coating system schedules summarize surfaces to be coated, required surface preparation, and coating systems to be applied. Coating notes on Drawings are used to show exceptions to schedules, to show or extend limits of coating systems, or to clarify or show details for application of coating systems.

C. Do not apply protective coatings to the following surfaces unless specifically named or shown to be coated:

1. Concrete.
2. Stainless steel, bronze, or brass.
3. Machined surfaces.
4. Grease fittings.
5. Glass.
7. Platform gratings, stair treads, door thresholds, and other walk surfaces.
8. Galvanized steel electrical conduit and associated galvanized and factory-coated junction boxes and electrical panels.
9. Galvanized surfaces inside buildings and not exposed to view.
10. Manhole and valve covers and rings, storm water inlet gratings, covers, and frames.

1.7 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit the following information at least 30 days prior to protective coating work:

1. Coating Materials List: Eight copies of a coating materials list naming the manufacturer and the coating number, keyed to the coating systems described in this Section. Submit the list prior to or at the time of sample submittal.

2. Paint Manufacturer’s Information: For each coating system to be used, submit the following data:
a. Paint manufacturer’s data sheet for each product proposed, including statements on the suitability of the material for the intended use.
b. Technical and performance information that demonstrates compliance with the system performance and material requirements.
c. Paint manufacturer’s instructions and recommendations on surface preparation and application.
d. Colors available for each product, where applicable.
e. Compatibility of shop and field applied coatings, where applicable.
f. Material Safety Data Sheet for each product used.

C. Samples:

1. Submit color samples of paint, finishes, and other coating materials on 8-1/2-inch by 11-inch sheet metal or heavy cardstock. Have each sheet completely coated over its entire surface with one protective coating material, type, and color.

2. Provide two sets of color samples to match each color selected by the Port Construction Representative from the manufacturer’s standard color sheets. If custom-mixed colors are indicated, prepare color samples using color formulations prepared to match the color samples furnished by the Port Construction Representative.

3. Submit one 15-pound sample of each abrasive proposed to be used for surface preparation for submerged and severe service coating systems.

1.8 QUALIFICATIONS

A. Where protective coatings are to be applied by a subcontractor, employ a subcontractor who possesses a valid state license as required for performance of painting and coating work called for in this Specification.

B. Submit 5 references which show that the painting subcontractor has previous successful experience with the indicated or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the painting subcontractor provided the protective coating.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Ventilate area where coating is being applied. Post and enforce “NO SMOKING OR OPEN FLAME” signs until coating has cured.

B. Provide lighting level of 80-foot candles (860 lx) measured mid-height at substrate surface.

C. Restrict worker access and construction traffic from area where coating is being applied or is curing.

PART 2 PRODUCTS

2.1 COATINGS CRITERIA

A. Suitability: Use suitable coating materials as recommended by the manufacturer.
B. Compatibility: In any coating system, use only compatible materials from a single manufacturer. Give particular attention to compatibility of primers and finish coats. If necessary, apply a barrier coat or tie coat between existing prime coat and subsequent field coats to ensure compatibility.

C. Containers: Supply coating materials in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all plainly legible at the time of use.

D. Colors: Use colors and shades of colors of all coats of paint as indicated on the coating schedules or selected by the Port Construction Representative. Make each coat of a slightly different shade to facilitate inspection of surface coverage of each coat. The Port Construction Representative will select finish colors from the manufacturer’s standard color samples.

E. Approved Substitution Products:
   1. Furnish satisfactory documentation from the manufacturer of the proposed substitute product that the material meets the indicated requirements and is comparable in the following properties:
      a. Resistance to abrasion and physical damage.
      b. Resistance to chemical attack.
      c. Life expectancy.
      d. Ability to recoat in future.
      e. Solids content by volume.
      f. Dry film thickness per coat.
      g. Compatibility with other coatings.
      h. Suitability for the intended service.
      i. Temperature limitations in service and during application.
      j. Type and quality of recommended undercoats and topcoats.
      k. Ease of application.
      l. Ease of repairing damaged areas.
      m. Stability of colors.
   2. For substitutions submit protective coating materials which are standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, provide the Port Construction Representative with the names of not less than 10 successful applications of the proposed manufacturer’s products which comply with these requirements.

2.2 INDUSTRIAL COATING SYSTEMS

A. Material Sources: Each of the following manufacturers is capable of supplying many of the specified industrial coating materials. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials will be considered as indicated under paragraph 2.1E. Provide industrial coating materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.

1. Ameron.
2. Carboline Coatings Company.
3. Devoe Coatings Company.
5. Inorganic Coatings, Inc.
7. Tnemec Company.
8. Valspar Corporation.

B. System 1 - Aliphatic Polyurethane: Two-component aliphatic acrylic polyurethane coating. Provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering and with a minimum solids content of 58 percent by volume. As primer use a rust inhibitive 2-component epoxy coating with a minimum solids content of 68 percent by volume.

1. Prime coat:
   a. DFT = 4 mils
   b. Products: Ameron 385, Carboline 893, Tnemec 69, or approved substitution.

2. Finish coats (one or more):
   a. DFT = 3 mils
   b. Products: Ameron Amershield, Carboline 134 HS, Tnemec 74, or approved substitution.

3. Total system DFT = 7 mils.
4. Apply more than one finish coat as necessary to produce a finish with uniform color and texture.

C. System 2 - Inorganic Zinc/Polyurethane: For prime coat, use inorganic zinc primer that is water or solvent-based, self-curing, zinc silicate 2-component inorganic coating which contains at least 85 percent of metallic zinc by weight in the dried film, and is recommended by the coating manufacturer as a primer for this system. As intermediate coat use a high-build, 2-component epoxy with a solids content of at least 70 percent by volume. For finish coats use a 2-component aliphatic acrylic or polyester polyurethane coating material that provides superior color and gloss retention, resistance to chemical fumes and severe weathering, and a minimum solids content of 58 percent by volume.

1. Prime coat:
   a. DFT = 3 mils
   b. Products: Ameron Dimetcote 21-5 or 21-9, Inorganic Coatings 531, Valspar 13-F-6, or approved substitution.

2. Intermediate coat:
   a. DFT = 4 mils
   b. Products: Ameron 385, Inorganic Coatings P24, Valspar 76, or approved substitution.

3. Finish coats (one or more):
   a. DFT = 3 mils
   b. Products: Ameron Amershield, Inorganic Coatings 64, Valspar 54, or approved substitution.

4. Total system DFT = 10 mils.
5. Apply intermediate coat in excess of 4 mils DFT or in more than one coat as necessary to completely cover the inorganic zinc primer and prevent application bubbling of the polyurethane finish coat.
6. Apply more than one finish coat as necessary to produce a finish with uniform color and texture.
7. If inorganic zinc primer is used as a pre-construction or shop-applied primer, and there are damaged or uncoated areas, spot blast the damaged area with abrasive and then coat with the specified material.
D. System 3 - Inorganic Zinc, Water-Based: Water-based, self-curing, zinc silicate coating with a 2-component inorganic coating material that contains at least 85 percent of metallic zinc by weight in the dried film.

1. Prime coat and finish coat (one):
   a. DFT = 3 mils
   b. Products: Ameron Dimetcote 21-5, Inorganic Coatings 531, Valspar 13-F-6, or approved substitution.

2. Total system DFT = 3 mils.

E. System 4 - Acrylic Latex: Single-component, water-based acrylic latex with a fungicide additive having a minimum solids content of 35 percent by volume. Apply a prime coat as recommended by manufacturer. Select coating material which is available in the ANSI safety colors.

1. Prime coat:
   a. DFT = 2 mils
   b. Products: As recommended by manufacturer.

2. Finish coats (2 or more):
   a. DFT = 6 mils
   b. Products: Ameron 220, Carboline 3300, Tnemec 6, or approved substitution.

3. Total system DFT = 8 mils.

F. System 5 - Epoxy, Equipment: Two-component, rust-inhibitive, polyamide-cured epoxy coating material with a recoatable finish that is available in a wide selection of colors. Minimum solids content of 66 percent by volume. Resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning.

1. Prime coat:
   a. DFT = 3 mils
   b. Products: Ameron 38P, Tnemec 69, or approved substitution.

2. Prime coat (where shop applied):
   a. DFT = 3 mils
   b. Products: Universal primer, Ameron 185 HS, Tnemec 50-330 or 161, or approved substitution.

3. Finish coats (2 or more):
   a. DFT = 6 mils
   b. Products: Ameron 385, Tnemec 69, or approved substitution.

4. Total system DFT = 9 mils.

G. System 6 - Aliphatic Polyurethane, Fiberglass: Two-component, aliphatic polyurethane coating material with superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering. Use a primer, tie coat, or mist coat recommended by the manufacturer.

1. Prime coat (tie coat): Ameron 385P, Tnemec P66, or approved substitution.

2. Finish coats (2 or more):
   a. DFT = 3 mils
   b. Products: Ameron Amershield, Tnemec 74, or approved substitution.
H. System 7 - Alkyd Enamel: High quality, gloss or semi-gloss, medium long oil alkyd finish with a minimum solids content of 49 percent by volume. Apply primer as recommended by manufacturer.

1. Prime coat:
   a. DFT = 3 mils
   b. Products: Ameron 5105, Tnemec P4-55, or approved substitution.

2. Finish coats (2 or more):
   a. DFT = 3 mils
   b. Ameron 5401 HS, Tnemec 2H, or approved substitution.

3. Total system DFT = 6 mils.

I. System 8 - Aluminum Metal Isolation: One coat of a high-build polyamide epoxy paint.

1. Products: Tnemec P66, or approved substitution

2. Total system DFT = 8 mils.

J. System 9 - Aluminum Silicone Resin: Aluminum silicone resin material suitable for a service temperature of up to 1000 degrees F. Complies with Federal Specification TT-P-28.

1. Prime coat and finish coat (2 or more):
   a. DFT = 3 mils
   b. Products: Tnemec Series 39-1061, Ameron 878, or approved substitution.

2. Total system DFT = 3 mils.

PART 3 EXECUTION

3.1 MANUFACTURER’S SERVICES

A. Require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary to resolve field problems attributable or associated with manufacturer’s products.

3.2 WORKMANSHP

A. Use skilled craftsmen and experienced supervision.

B. Apply coating to produce an even film of uniform thickness. Give special attention to edges, corners, crevices, and joints. Ensure thorough cleaning and an adequate thickness of coating material. Apply coatings to produce finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. Effect complete hiding so that the addition of another coat would not increase the hiding. Give special attention to ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas. Protect installations by use of drop cloths or other precautionary measures.

C. If surfaces are damaged, clean, repair, and refinish to original condition.
3.3 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer’s Recommendations: Unless otherwise indicated, strictly comply with the coating manufacturer’s printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating.

B. Use protective coating materials within the manufacturer’s recommended shelf life.

C. Storage and Mixing: Store coating materials under conditions recommended by the Material Safety Data Sheets. Keep coating materials thoroughly stirred, strained, and with uniform consistency during application. Do not mix coatings of different manufacturers.

3.4 PREPARATION FOR COATING

A. Cleaning and Touch-up: Clean surfaces to receive protective coatings. Examine surfaces to be coated. Correct surface defects before application of any coating material. Touch up marred or abraded spots on shop-primed and on factory-finished surfaces prior to coating application. Verify that surfaces to be coated are dry and free of visible dust.

B. Protection of Surfaces Not to be Coated: Protect surfaces which are not to receive protective coatings during surface preparation, cleaning, and coating operations.

C. Remove, mask or otherwise protect hardware, lighting fixtures, switchplates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces to be painted. Provide drop cloths to prevent coating materials from falling on or marring adjacent surfaces. Protect the working parts of mechanical and electrical equipment from damage during surface preparation and coating operations. Mask openings in motors to prevent entry of coating or other materials.

D. Do not damage adjacent work during blast cleaning operations. Conduct spray painting under carefully controlled conditions. Promptly repair any damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. Protection of Painted Surfaces: Coordinate cleaning and coating so that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

3.5 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation standards of the Steel Structures Painting Council form a part of this Specification:

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.


4. **White Metal Blast Cleaning (SSPC-SP5):** Removal of visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products, and foreign matter by blast cleaning.

5. **Commercial Blast Cleaning (SSPC-SP6):** Removal of visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining is limited to no more than 33 percent of each square inch of surface area.

6. **Brush-off Blast Cleaning (SSPC-SP7):** Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.

7. **Near-white Blast Cleaning (SSPC-SP10):** Removal of visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining is limited to no more than 5 percent of each square inch of surface area.

### 3.6 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A. For galvanized ferrous metal use the alkaline cleaned method per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system.

B. Apply pretreatment coatings of surfaces in accordance with the printed recommendations of the coating manufacturer.

### 3.7 APPLICATION OF COATINGS

A. Apply protective coatings to steel substrates in accordance with SSPC-PA1 - Paint Application Specification No. 1.

B. Inspect cleaned surfaces and each coat prior to succeeding coats. Schedule inspections with the Port Construction Representative in advance.

C. Paint blast-cleaned ferrous metal surfaces before rusting or other deterioration of the surface occurs. Limit blast cleaning to only those surfaces that can be coated in the same working day.

D. Apply coatings in accordance with the manufacturer's instructions and this Section, whichever has the most stringent requirements.

E. Give special attention to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely occur. Use hand stripe painting for these areas.

F. Give special attention to materials which will be joined so closely that proper surface preparation and application are not possible. Coat such contact surfaces prior to assembly or installation.

G. Apply finish coats, including touch-up and damage repair coats, in a manner which will present a uniform texture and color matched appearance.

H. Do not apply coatings under the following conditions:

1. Temperature outside of the manufacturer's recommended minimum and maximum range.
2. Dust or smoke laden atmosphere.
3. When the substrate or air temperature is less than 5 degrees F above dew point.
4. When air temperature is expected to drop below 40 degrees F or less than 5
degrees F above the dew point within 8 hours after application of coating.
5. When wind conditions are not calm.

I. Determine the dew point by use of a sling psychrometer in conjunction with U. S.
Department of Commerce, Weather Bureau psychrometric tables.

J. Apply finish coats after concrete, masonry, and equipment installation is complete and
the work areas are clean and dust free.

3.8 CURING OF COATINGS

A. Maintain curing conditions in accordance with the recommendations of the coating
material manufacturer and this Section, whichever is the most stringent. Complete curing
before placing the coating systems into service.

B. In the case of enclosed areas, forced air ventilation using heated air if necessary, may be
required until the coatings have fully cured.

C. Forced Air Ventilation of Enclosed Hydraulic Structures: Forced air ventilation is required
for the application and curing of coatings on the interior surfaces of enclosed hydraulic
structures. During application and curing periods, continuously exhaust air from the
lowest level of the structure using portable ducting. After interior coating operations have
been completed, provide a final curing period for a minimum of 10 days, operating the
forced air ventilation system continuously.

3.9 SHOP AND FIELD INSPECTION AND TESTING

A. Give the Port Construction Representative a minimum of 3 days advance notice of the
start of any field surface preparation work or coating application work, and a minimum of
7 days advance notice of the start of any shop surface preparation work.

B. Perform surface preparation and coating applications in the presence of the Port
Construction Representative.

C. Inspection by the Port Construction Representative, or the waiver of inspection of any
particular portion of the work, does not relieve the Contractor of his responsibility to
perform the Work in accordance with these Specifications.

D. Erect and move scaffolding where requested by the Port Construction Representative to
facilitate inspection. Provide additional illumination to light areas to be inspected.

E. Inspection Devices: Until final acceptance of coatings, furnish inspection devices in good
working condition for the detection of holidays and measurement of dry-film thicknesses
of protective coatings. Make dry-film thickness gauges available for the Port
Construction Representative’s use while coating is being done, until final acceptance of
such coatings. Provide the services of a trained operator of the holiday detection devices
until the final acceptance of such coatings. Operate holiday detection devices in the
presence of the Port Construction Representative.
F. Holiday Testing: Perform holiday tests on coated ferrous surfaces inside a steel reservoir, other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Mark and repair or recoat areas which contain holidays in accordance with the coating manufacturer’s printed instructions and then retest.

1. Coatings with Thickness Exceeding 20 Mils: For surfaces having a total dry-film coating thickness exceeding 20 mils; use a pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or approved substitution. Adjust the unit to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Coatings with Thickness of 20 Mils or Less: For surfaces having a total dry-film coating thickness of 20 mils or less, use Tinker & Rasor Model M1 nondestructive-type holiday detector, K-D Bird Dog, or approved substitution. Use a unit that operates at less than 75-volts. For thicknesses between 10 and 20 mils, add a non-sudsing-type wetting agent, such as Kodak Photo-Flo, or approved substitution, to the water prior to wetting the detector sponge.

G. Film Thickness Testing: On ferrous metals, measure the dry-film coating thickness in accordance with the SSPC Paint Application Specification No. 2 using a magnetic-type dry-film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, or approved substitution. Test each coat for the correct thickness. Do not take measurements until at least 8 hours after coating application. On non-ferrous metals and other substrates, measure the coating thicknesses at the time of application using a wet-film gauge.

H. Surface Preparation: Evaluation of blast-cleaned surface preparation work will be based upon comparison of the blasted surfaces with standard samples using NACE Standard TM-01-70.

3.10 PAINTING AND IDENTIFICATION OF PIPING

A. Painting and Color Coding.

1. Use colors and signs to identify all piping which is exposed to view in buildings or tunnels, above suspended ceilings, or exposed above grade, and all outdoor piping. Identify each pipe by a color complying with the following schedule of colors and by applied markers.

2. Coat pipes in the number of coats and type of material specified. Base coats for pipeline painting may be the same neutral color. Make each succeeding base coat a slightly different color. For the final coat, comply with the pipe identifying color schedule.
A. Coating System Schedule, Ferrous Metal - Galvanized: Apply pretreatment coatings, barrier coatings, or washes as recommended by the coating manufacturer.

<table>
<thead>
<tr>
<th>SCHEDULE NO. AND APPLICATION</th>
<th>SURFACE PREPARATION</th>
<th>SYSTEM NO./ DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMG-1: Exposed surfaces indoors and outdoors, except those listed below.</td>
<td>Alkaline cleaning SSPC-SP1</td>
<td>(1) Aliphatic polyurethane</td>
</tr>
<tr>
<td>FMG-2: Surfaces in chlorination room, chlorine storage room, sodium hypochlorite storage room.</td>
<td>Alkaline cleaning SSPC-SP1</td>
<td>(100) Amine-cured epoxy</td>
</tr>
<tr>
<td>FMG-3: Surfaces submerged in water or wastewater, including surfaces lower than 2 feet above high-water level and surfaces inside enclosed hydraulic structures and vents.</td>
<td>Alkaline cleaning SSPC-SP1 followed by brush-off grade blast cleaning SSPC-SP7</td>
<td>(100) Amine-cured epoxy</td>
</tr>
<tr>
<td>FMG-4: Surfaces exposed to view, inside and outside of building.</td>
<td>Alkaline cleaning SSPC-SP1</td>
<td>(1) Aliphatic polyurethane</td>
</tr>
</tbody>
</table>

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 10 46 50.00 Add - DRILLED SHAFT FOUNDATIONS

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes requirements for the construction of foundations consisting of reinforced concrete drilled shafts.

1.2  RELATED SECTIONS

A. 03 20 00.00 – Structural Concrete Reinforcement

B. 03 30 00.00 – Cast-in-Place Concrete

1.3  REFERENCES

A. ACI 336.1 – Specifications for the Construction of Drilled Piers

1.4  MEASUREMENT AND PAYMENT

A. Subject to Section III, when called for as a foundation for high-mast lighting, drilled shaft foundations shall be measured and paid for by Each installed foundation, as noted on the proposal sheets. Payment shall be full compensation for providing all labor, materials, excavation and equipment necessary to complete the installation of the high-mast lighting foundation, including high mast pole anchor bolts.

B. No separate or additional payment will be made for surface water control, ground water control, or for excavation drainage. Include in the unit price for the drilled shaft foundation.

1.5  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit work plan for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to drilled shaft activities. Descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to the Port Construction Representative that procedures meet requirements of Specifications and Drawings.

C. Record locations of drilled shafts, as installed referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.
PART 2  PRODUCTS

2.1 EQUIPMENT

A. Perform excavation with equipment suitable for achieving requirements of this Specification.

2.2 MATERIAL

A. For cast-in-place concrete, use Class A concrete. Refer to Section 03 30 00.00.

B. For reinforcing steel, refer to Section 03 20 00.00 – Structural Concrete Reinforcement.

PART 3  EXECUTION

3.1 PREPARATION

A. Conduct an inspection to determine condition and locations of existing structures and other permanent installations, prior to commencing work.

3.2 EXCAVATION

A. Perform excavation required for drilled cylindrical shafts, at locations shown on Drawings through whatever materials encountered, to dimensions and elevations shown or required by site conditions. When satisfactory material is not encountered at plan depth, bottom of shaft will be adjusted or foundation altered, as determined by the Port Construction Representative, to satisfactorily comply with design requirements.

1. Do not make shaft excavations within 3 shaft diameters (edge to edge) of shafts which have been concreted within previous 24 hours.

2. Inspect drilled shaft excavations for verticality and side sloughing. Verticality is specified at one inch in 10 feet of shaft length. Check to full depth of dry auguring prior to introducing drilling mud. Straighten or add suitable reinforcing steel to shafts not meeting specified tolerance.

3. Slurry is to contain 4 to 8 percent by weight of bentonite additive and satisfy slurry specifications set forth in ACI 336.1, Section 2.3.5.2e. Stricter slurry specifications are required to assure suspension of detritus from drilling operations, and to ensure adequate cleaning of slurry prior to concreting. Cleaning of slurry is important to prevent deposition of detritus on reinforcement cages and ensure that inclusions of detritus will not be formed within concrete mass.

B. At final bearing elevation, clean bottom of each shaft and remove seepage water for examination by the Port Construction Representative before reinforcing steel and concrete is placed. Suitable access and lighting for proper inspection of completed excavation is to be provided. Reinforcing steel and concrete is to be placed in drilled shaft without delay after approval of excavation by the Port Construction Representative.

3.3 DRILLED SHAFT CONSTRUCTION

A. Drilled shaft construction and installation is to follow ACI 336.1.
1. Before placing concrete, clean out shaft bottom with drilling bucket in order to remove sediments which may not be displaced by concrete. Clean shaft bottom with "clean-out" bucket until rotation on bottom without crowd (i.e., penetration under force) produces little spoil. Probing after cleaning out is essential to verify condition of base of shaft.

2. Concrete is to conform to requirements of ACI 336.1.

3. Concrete is to be placed continuously in shaft to construction joint indicated on Drawings. Concrete is to be placed through suitable tube or tremie to prevent segregation of materials. Tremie pipe diameter is to be at least 8 times as large as largest concrete aggregate size.

4. Computation of final concrete volume for each shaft is to be made. Core and check the integrity of shafts taking an unreasonably high or low volume of concrete.

5. If caving soil conditions or excessive groundwater is encountered, use of temporary casing is permitted to prevent caving of material around shaft and to control seepage of groundwater into excavation.

6. Casing material is to be metal of ample strength to withstand handling stresses, pressure of concrete and of surrounding earth or backfill materials and is to be water-tight. Casing shall be smooth, clean and free of accumulations of hardened concrete. Outside diameter of casing is not to be less than specified diameter of drilled shaft.

7. Elapsed time is not to exceed one hour, or the time which the concrete maintain a slump of over 4 inches, whichever is less, from beginning of concrete placement in cased portion of shaft, until extraction of casing is begun.

8. Withdraw temporary casings as shaft is filled with concrete, or immediately following concreting operation. Bottom of casing is to always remain at least one foot below level of concrete during placement to overcome hydrostatic pressure. Smoothly extract casing with vibratory hammer. Casing extraction is to be at slow, uniform rate with pull in line with vertical axis of shaft. Leave no casing in place.

9. If upward movement of concrete or reinforcing steel occurs inside casing at beginning of pulling operation or at anytime during pulling, stop pulling immediately and leave casing in place.

10. If casing must be left in place, the Port Construction Representative is to be informed to determine shaft capacity calculations.

3.4 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of the General Conditions.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes basic requirements specifically applicable to the work of Division 26 - Electrical Requirements.

B. The Contractor shall furnish all equipment, materials, and labor for complete assembly and installation plus field testing and commissioning of the complete electrical system as shown on the Drawings and stipulated in the Specifications.

C. The following is a brief list of work to be completed, as shown on plans.

1. A complete 12.47 kV primary distribution system including underground cable installation, unitized substations and vacuum loop switches and connections thereof.
2. A complete secondary 480: 120/208 volt distribution system including conduits, cables, panel boards, dry type transformers, and reefer receptacles and connections.
3. A complete grounding system including lightning protection system and extension of facilities ground system.
4. A complete underground ductbank system for primary and secondary power distribution, communication, and security systems for both new and future use.
5. A complete high-mast lighting system including luminaries, lowering assemblies, poles, foundations, wiring, and switches.
6. Complete testing and commissioning of the complete installation including 12.47 kV system submitting all certified factory test reports, and signed, witnessed field test reports.

D. Contractor Qualifications

1. The Electrical Contractor shall have a minimum of 5 years experience in work for facilities of this type and size and shall submit experience record for Port Construction Representative’s review upon request.
2. The Electrical Contracting Company and Electricians shall have current State of Texas licenses as required by law and shall adhere to the License Board requirements while performing duties for this project.
3. The Electrical Contractor shall have direct, recent experience in underground ductbank systems. See requirements of plans and specifications for detailed requirements.
4. All medium voltage work shall be directly supervised by a Master Electrician licensed by the State of Texas.
5. The Contractor shall have a current ongoing safety training program and shall present published safety manuals for review where required by Port Construction Representative.
1.2 REFERENCES

A. Applicable Standards: Comply with the latest editions of the following standards:

2. National Electrical Manufacturers Association (NEMA):
   a. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   b. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   c. NEMA WD 1 - Wiring Devices.
5. Underwriters Laboratories (UL):
   a. UL 6 - Rigid Metal Conduit.
   b. UL 44 - Rubber-Insulated Wires and Cables.
   c. UL 50 - Cabinets and Boxes.
   d. UL 467 - Grounding and Bonding Equipment.
   e. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   f. UL 486C & D - Splicing Wire Connectors and Standard for Insulated Wire Connectors for use with Underground Conductors.
   g. UL 489 - Molded-Case Circuit Breakers and Circuit-Breaker Enclosures.
   h. UL 498 - Attachment Plugs and Receptacles.
   i. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
   j. UL 514A - Metallic Outlet Boxes.
   k. UL 514B - Fittings for Conduit and Outlet Boxes.
   l. UL 886 - Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.
   m. UL 943 - Ground-Fault Circuit Interrupters.
   n. UL20 - Wiring Devices.
   o. UL231.8 - Wiring Devices.
   p. UL1056 - Wiring Devices.
   q. ASTM A123.8 Galvanizing.
   r. ASTM A153 - Galvanizing.
   s. UL67 - Panelboards.
   t. UL-98 - Enclosed Switches.
   u. UL-198-3 - Fuses CL-K.
   v. UL-198-4 - Fuses CL-R.
7. National Electrical Code:
9. Other applicable Codes and Standards as referenced in other Specifications.
10. Comply with current local, county, state, and federal regulations and codes in effect.
11. Equipment from foreign manufacture must meet U.S. codes and standards.
12. Equipment and materials shall conform to requirements of specification and to the criteria provided in data sheets for the project.
1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and piping as may be required by the Port Construction Representative.

C. Equipment submittals, acceptance-testing plans and the shop drawings shall be submitted as complete and contiguous packages. Partial or unmarked submittals will not be accepted for review.

D. Clearly delineate (with highlighter, arrow, or underline) on each specification sheet, which model numbers, options, and configurations are being proposed for this project.

E. Each page in the submittal shall be numbered sequentially.

F. Submittals shall be provided in electronic Portable Document Format (PDF).

G. Indicate that all equipment, devices, and materials submitted are UL listed.

H. Indicate all substitutions where proposed equipment, devices, and materials do not meet requirements of plans and/or specifications.

I. Any items not submitted are not approved and shall not be manufactured, delivered to job site, or installed.

J. See Paragraph 3.5 – “Operation and Maintenance Manuals” for additional requirements.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. Field Inspection:

1. Electrical work shall be inspected and approved by the Port Construction Representative.

2. Contractor shall give a minimum of three days notice to the Port Construction Representative that the installation is ready for inspection.

3. Concealed work shall be inspected before it is covered:
   a. Conduit with stub-ups, underground in ductbanks before concrete is poured.
   b. Conduit in slabs, walls and ceilings, complete with boxes.
   c. Exothermic welds for grounding conductors.
   d. Conductor splices – where permitted.

4. Electrical equipment and materials shall be inspected upon arrival by the Port Construction Representative for compliance with specifications.
1.5 SITE CONDITIONS

A. Take the following site conditions into consideration when fabricating, erecting, installing and wiring electrical equipment under this contract:

1. Site Location: Bayport (Seabrook, Texas)
2. Site Type and Size: Industrial.
3. Site Elevation: Sea level.
4. Seismic Zone: Zone 0.
5. Wind Velocity: 100 mph with gusts up to 130 percent.
6. Temperature, Min. / Max.
   a. Coldest Winter Month: High: 60 degrees F; Low: 41 degrees F.
   b. Warmest Summer Month: High: 105 degrees F; Low: 73 degrees F.
   c. Lowest Expected: 11 degrees F.
   d. Highest Expected: 107 degrees F.
7. Rainfall:
   a. Annual: 45 inches.
   b. Design: 3.4 inches/hour, 8.4 inches/24 hours.
8. Design Relative Humidity: 98%.
9. Station Barometric Pressure:
   a. Average Annual: 29.5 inches Hg absolute.

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Phase</th>
<th>Hz</th>
<th>Wire</th>
<th>Delta or Wye</th>
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<td>480/277</td>
<td>3Ph</td>
<td>60HZ</td>
<td>4W</td>
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<tr>
<td>2</td>
<td>120/240</td>
<td>3Ph</td>
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<tr>
<td>4</td>
<td>120/208</td>
<td>3Ph</td>
<td>60HZ</td>
<td>4W</td>
</tr>
</tbody>
</table>

1.6 MEASUREMENT AND PAYMENT – NEW CONSTRUCTION

A. No separate payment shall be made for work under this section. Include costs of basic electrical requirements in this Section in unit pricing for items which it is a component part.

1.7 MEASUREMENT AND PAYMENT – MANHOLE REHABILITATION

A. Payment for ‘Separate Mixed Voltage Conductors’ will be on a unit price basis, per Each manhole, for material, labor, equipment, and all other incidentals required, complete in place and accepted. Payment for re-racking cables shall be in accordance with Section 26 05 13.16.

B. Expected quantities are shown on plan sheet E-169A. Quantities on the bid form may exceed expected quantities to allow for unforeseen conditions.
1.8 GENERAL REQUIREMENTS AND RESPONSIBILITIES

A. General Contractor is solely responsible for coordinating all electrical requirements of all equipment installed under this contract. Electrical Subcontractor shall confirm this with General Contractor before bidding.

Within ten (10) days of “Notice to Proceed,” the General Contractor shall appoint a person responsible for coordination of all electrical controls and equipment that are a part of this project and shall, at that time, notify the Port Construction Representative in writing of that person’s name, telephone number, fax number, address, and all other pertinent information.

B. This specification section is an inherent part of all work performed on this project and its contents shall apply for all electrical power, control and instrumentation related work. Contractor shall advise all Subcontractors and Vendors accordingly.

C. Warning: Electrical systems for this project have lethal voltages present. Contractor shall not work on energized equipment except when absolutely necessary and then only in the presence of another trained, experienced Electrician and with proper protective gear. See specification for safety training requirements.

D. Installation shall conform to most recent National Electrical Code, International Building Code, and Local Codes. In addition, Contractor shall follow all requirements of NFPA 70E - “Standard for Electrical Safety in the Work Place.” Of specific importance are all the requirements of Article 400.11 – “Flash Protection.”

E. Plans and diagrams are illustrative and may not contain all devices wiring and controls required to perform the function intended without reference to specifications.

F. Methods of work and devices described in all electrical specification sections are intended to facilitate a properly constructed and operating electrical system that meets Owner’s operational requirements and satisfies the requirements of local and national codes. The Port Construction Representative may approve methods or devices that vary from the requirements described in any particular specification if, in the Port Authority’s judgment, the installation meets the intent of the Port Construction Representative and, where the electrical system performance meets the general requirements of the facility operation and, where the installation is deemed to present a safe installation that does not present a danger to persons operating or maintaining the electrical installation. This variance may be authorized during the submittal or inspection stage of the project, as the Port Authority deems appropriate.

G. All equipment, conduits, panels, and devices shall be installed in the most strict, professional manner to present a neat installation. Where a question arises concerning intent of method for installation or where details are not clear, Contractor is to contact the Port Authority for clarification before proceeding with work. Any work not suitable or not installed in a professional manner will be modified to an installation acceptable to the Port Authority at no additional cost.

H. Substitutions for equipment specified or shown on plans shall be as pre-approved prior to bidding unless specified or shown on plans as “or equal.” Where noted as “pre-approved,” indicates approval is required prior to bid acceptance.
I. The work shall include providing materials and equipment required for installation of a complete and functioning electrical system as specified and as shown on the drawings.

J. This section is an integral part of all Specification Sections related to electrical, control and instrumentation construction under this contract. Contractor shall check all other plans and specifications for this project and include items and circuits accordingly.

The total set of construction documents make up the requirements for work for this project and shall be included in Contractor’s bid at no additional cost to the Port Authority.

K. All plans and specifications for this project are representative of the design intent and may not contain minute details associated with normally accepted electrical construction, as described in applicable codes or as described in manufacturer’s literature. Contractor shall provide all appurtenances normally associated with a particular equipment or device, and as required for a proper operating system. Some devices, equipment, or materials may appear in only one location on the plans or in the specifications. Each and every item shown or described is to be included for this project. No exceptions. All required circuits and devices necessary for intended operation are to be included without additional cost to the Port Authority. Where discrepancies occur between various plans or specifications for this project and where clarification is not requested by Contractor prior to bidding, the most stringent request shall be included in the Contractors bid price. Electrical Sub-Contractor shall review all specifications for all trade disciplines with electrical requirements prior to bidding and shall include most stringent and higher cost requirements in bid price. No elements or requirements of the plans or specifications shall be omitted in Contractor’s bid price unless specifically deleted in writing by the Port Authority. Failure to follow this specification requirement is at Contractor’s expense and at no additional cost to the Port Authority.

L. Electrical Contractor shall have Master Electrician License for City or County; in which project is located, and shall have a State issued Master Electrician License.

M. Contractor shall have an established safety-training program in effect for the duration of this project and will be required to submit proof of safety training for all employees working on this project.

N. Where work disrupts power and/or control to new or existing equipment, furnish temporary bypass circuits, as required, to maintain equipment operation.

O. Where work involves additions, modification, demolition, or renovations to existing facilities, Contractor shall remove, relocate, and extend existing installations to accommodate new construction. This includes relocation of conduits, equipment, and materials that may obstruct placement of new equipment. Contractor shall field observe existing conditions prior to submitting a bid to become familiar with existing conditions and shall account for any relocations or extensions in bid. Refer to “As-Built” drawings and existing O&M Manuals. Failure to do so is at Contractors’ risk and at no additional cost to the Port Authority.

P. Where any equipment performance does not conform to specifications or, where in the Port Authority’s opinion, parameters are out of tolerance or erratic in performance, the Contractor shall remove and replace equipment at no additional cost to the Port Authority.
Q. Location of outlets and equipment shown on Drawings is approximate. Field verify exact location. Minor modification in location of outlets and equipment is considered incidental up to distance of 20 feet with no additional compensation.

R. Contractor shall provide the equipment necessary for locating all underground pipes, conduits, and structures before digging. All locations of intersection shall be properly staked and identified.

Locating all underground lines is the sole responsibility of the Contractor and shall be at no additional cost to the Port Authority. Any damage to underground utilities is the responsibility of the Contractor.

S. All conduits stubbed out for future use shall be routed clear of all paving, structures, or any other obstruction that may limit future access for connection to conduits. Unless shown otherwise, stub out minimum 5 feet clear and cap end of conduit. Do not apply adhesive or cement to PVC caps at end of conduit. Install marker at end of conduit.

T. All equipment and devices shall be installed according to manufacturer’s instructions. Coordinate installation with manufacturer’s representative to assure correct installation methods have been applied. Prior to submittal review, Manufacturer’s Representative shall review plans and specifications and shall notify Port Construction Representative in writing where application shown on plans will not provide satisfactory and/or accurate performance. Failure to abide by this requirement shall be at Contractor’s risk and cost. All equipment and materials shall be rated for the harsh Industrial, Electrical, and Mechanical environment in which installed and shall be warranted by manufacturer accordingly.

U. All underground manholes and pull boxes to have cable racks and grounding. Cables and conductors are to be neatly dressed on racks around perimeter walls and properly secured to racks and tagged. Provide ample slack in cables and conductors. No splicing will be allowed where there is not enough slack to route cables and conductors around perimeter and, new ones will be installed at no additional cost to the Port Authority.

V. All testing agencies shall be NETA certified.

PART 2 PRODUCTS

2.1 COMPONENT DESIGN

A. Components utilized in the construction of the material or equipment shall be of the latest proven design, new and in current production. Do not use obsolete components or components to be phased out of production.

2.2 FACTORY INSPECTION

A. Provide free access with prior notice for the Port of Houston Authority and Port Construction Representative at all times to the shop where the material or equipment is being fabricated or tested. Provide reasonable facilities for inspection, witnessing tests, and examining records. Give 7-days notice prior to starting tests that are scheduled for factory inspection.
PART 3 EXECUTION

3.1 PREPARATION

A. Verify dimensions and ratings of equipment and materials to ensure proper fit and performance.

3.2 INSTALLATION

A. Install equipment and materials in accordance with the Drawings and manufacturer's written instructions. If field conditions necessitate changes in electrical installation, obtain approval from the Port Construction Representative.

B. Install all NEC required safety signage including high voltage warning and arc flash warning signs per NEC Article 100.

3.3 TESTING AND COMMISSIONING

A. All testing to be performed in compliance with NETA Acceptance Testing Specifications.

B. Test the electrical system to specification requirements and to demonstrate correct installation and operation of equipment.

C. Test all systems according to requirements of Section 26 08 00 – “Field Testing” and Section 26 08 00.01 – “Medium Voltage System Commissioning Tests.”

3.4 TRAINING

A. Provide training sessions at the construction site for the number of assigned personnel, for five (5), eight (8) hour days or as required by the Port Construction Representative. This requirement is in addition to specific requirements in other specification sections covering equipment.

B. The training sessions shall be conducted by a manufacturer's qualified Technicians and representative near the end of construction when all equipment is in operating condition. The training program shall consist of the instruction on the operation of the equipment assemblies, circuit breakers, switches, major components, protective relaying, and associated documentation.

C. The training program shall consist of instructions for start-up, testing, operating, and troubleshooting of the specified equipment. Full documentation and software shall be introduced and provided at the sessions as follows;

1. Training Manual
2. Standard Manual for Operation and Maintenance, Testing and Troubleshooting

D. Parts List and Recommended Spare Parts
A. The Contractor shall submit the O&M manual in electronic Portable Document Format (PDF) for review and approval by the Port Construction Representative 30 days prior to energizing equipment. Upon approval of the O&M manual, the Contractor shall submit six (6) complete hard copy sets of approved O&M manuals bound in a three –ring binder and provide in PDF on CD with printed label.

B. The manuals shall include wiring diagrams and operating and maintenance literature for all components provided under Division 26. The submitted literature shall be in sufficient detail to facilitate the operation, removal, and installation, programming and configuration, adjustment, calibration, testing and maintenance of each components and/or instrument.

The O&M manual shall be professionally composed and complied and shall not be an assembly of cut sheets. Each page of the O&M manual shall be numbered sequentially. Port Construction Representative shall have sole discretion of acceptance of O&M manual contents and composition.

C. The contents of the O&M manuals shall be generally organized as follows:

1. System Hardware/Installation
2. System Software (where applicable)
3. Operation (Step-by-Step Procedures)
4. Electrical and Control Wiring Diagrams
5. Maintenance and Troubleshooting
6. Warranty Certificates

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for medium voltage power cable.

1.2 REFERENCES

   1. ASTM B3: Soft or Annealed Copper Wires.
   2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
   3. ASTM B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Institute of Electrical and Electronics Engineers (IEEE): IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.

C. Insulated Cable Engineers Association (ICEA).
   1. ICEA P-45-482: Short-Circuit Performance of Metallic Shielding and Sheaths of Insulated Cable.
   2. ICEA S-93-639/NEMA WC 74
   6. ICEA S-105-692: 600 Volt Single Layer Thermoset Insulated Utility Underground Distribution Cable

D. Underwriters' Laboratories (UL): UL 1072: Medium-Voltage (Type MV) Solid-Dielectric Cables.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Construction Representative. At the minimum, the following are required:
   1. Completed manufacturer's data sheets.
   2. Manufacturer's cut sheets, catalog data.
   3. Name of electrical testing company to be employed.
   4. Impulse voltage test record.
   5. Installation, terminating and splicing procedure.
   6. Instruction for handling and storage.
   7. Dimensions and weight.
   8. Conformance certificate.

C. Submit cable pulling plan in compliance with Paragraph 3.2 entitled “Cable Pulling Plan.”

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. Cable shall be tested at the factory to confirm that the cable complies with requirements of ICEA S-93-639/NEMA WC 74.

1.5 DELIVERY STORAGE AND HANDLING

A. Ship cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

1.6 MEASUREMENT AND PAYMENT – NEW CONSTRUCTION

A. Payment for ‘15 kV Copper Medium Voltage Power Cable’ shall be on a Lump Sum basis for material, labor, equipment, and all other incidentals required, complete in place and accepted.

1.7 MEASUREMENT AND PAYMENT – MANHOLE REHABILITATION

A. Payment for ‘Re-Rack Cables’ for medium voltage power cable relocation and re-racking shall be on a unit price basis, per Each manhole, for material, labor, equipment, and all other incidentals required, complete in place and accepted.

B. Payment for ‘Replace Medium Voltage Power Cable Splices’ shall be on a unit price basis, per Each manhole, for material, labor, equipment, and all other incidentals, testing
and certification, required, complete in place and accepted.

C. Payment for ‘Install/Repair Arc Proofing (Fire Tape) on MV Cables’ shall be on a unit price basis, per Each manhole, for material, labor, equipment, and all other incidentals, testing and certification, required, complete in place and accepted.

D. Expected quantities are shown on plan sheet E-169A. Quantities on the bid form may exceed expected quantities to allow for unforeseen conditions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. American Insulated Wire Company.

B. Cablec Continental Cables Company.

C. General Cable Company.

D. Okonite Company.

E. Triangle Wire and Cable, Inc.

F. Southwest Wire

2.2 MATERIALS AND EQUIPMENT

A. Design: Provide cable with the following design characteristics. Cable shall be UL listed type MV-105 suitable for operation on a medium voltage (grounded or ungrounded) system. Provide cable rated three phase, three wire, 60 Hz with an insulation level and a continuous conductor temperature as specified on the data sheets. The conditions apply in wet or dry locations whether installed in underground duct or conduit. Use three-conductor cable only where indicated.

B. Conductors: Provide conductors, which are bare, uncoated copper or tinned, class B stranded per ASTM B3, B8 and B33 or, compact stranded conductors, unless otherwise specified. Size conductors in conformance with at least the minimums given in ICEA S-93-639/NEMA WC 74. Provide the number and size of conductors supplied as indicated on the Drawings. Conductors shall be shielded, single conductor cables having compact stranded, bare copper conductors; extruded semi-conducting strand shield; ethylene propylene rubber (EPR) insulation; extruded semi-conducting insulation shield with bare copper tape shield; and polyvinyl chloride (PVC) jacket. Cables shall be rated at 15,000 volts, 105 degrees Celsius, wet or dry locations, and meet the requirements of ICEA S-93-639 (NEMA WC 74), AEIC CS-6 and CS-8, Articles 328 and 310 of NEC and UL-1072.

C. Conductor Shielding: Use conductor with a shield composed of semi-conducting tape applied in accordance with ICEA S-93-639/NEMA WC 74.

D. Insulation: Conductor insulation as specified shall conform to the physical and electrical requirements of ICEA S-93-639/NEMA WC 74.

E. Insulation Shielding: Provide each insulated conductor with an insulation shield consisting of a nonmetallic covering located directly over the insulation and a
nonmagnetic metal component directly over or embedded in the covering. The materials used in the insulation shield and the method of construction shall comply with ICEA S-93-639/NEMA WC 74 and UL-1072. The short-circuit capacity of the conductor insulation shielding shall be the larger value of either the capacity defined in ICEA P-45-482 or that shown in the following table:

<table>
<thead>
<tr>
<th>Shield Diameter</th>
<th>Short-Circuit</th>
<th>Short-Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td>Amps for 8 Cycles</td>
<td>Amps for 16 Cycles</td>
</tr>
<tr>
<td>1/2</td>
<td>1400</td>
<td>1000</td>
</tr>
<tr>
<td>3/4</td>
<td>2100</td>
<td>1500</td>
</tr>
<tr>
<td>1</td>
<td>2800</td>
<td>2000</td>
</tr>
<tr>
<td>1-1/4</td>
<td>3500</td>
<td>2500</td>
</tr>
<tr>
<td>1-1/2</td>
<td>4200</td>
<td>3000</td>
</tr>
<tr>
<td>1-3/4</td>
<td>5000</td>
<td>3500</td>
</tr>
<tr>
<td>2</td>
<td>5700</td>
<td>4000</td>
</tr>
<tr>
<td>2-1/4</td>
<td>6400</td>
<td>4500</td>
</tr>
<tr>
<td>2-1/2</td>
<td>7100</td>
<td>5000</td>
</tr>
<tr>
<td>2-3/4</td>
<td>7800</td>
<td>5500</td>
</tr>
<tr>
<td>3</td>
<td>8500</td>
<td>6000</td>
</tr>
</tbody>
</table>

F. Jacket. When medium voltage power cables are enclosed in conduit, duct or in other raceway systems, the cables shall be of the non-armored type with an overall nonmetallic jacket covering single- and three-conductor cables conforming to the requirements of ICEA S-93-639/NEMA WC 74.

G. Armor. When medium voltage power cables are exposed in cable tray, cable channel or other cable support systems, the three-conductor cables shall be protected by an interlocked metal armor made of galvanized steel or aluminum, which meets the requirements of ICEA S-93-639/NEMA WC 74.

H. Marking. Mark the jacket of cables as required by paragraphs 201, 202, 203, and 204 of UL 1072, unless otherwise specified.

I. Medium Voltage Cable Identification:

1. Identify cables as to phase and circuit at each accessible location. Identification to be accomplished by means of brass tags permanently affixed to cable embossed in letters no less than ½ inch high.
2. Arrange tags such that they can be read without moving cables.
3. See Section 26 05 53 – “Electrical Identification” for additional requirements.

J. Termination Devices:

1. Provide wiring terminals and cable lugs of adequate size and quantity to accommodate all of the required conductors and cables.
PART 3 EXECUTION

3.1 GENERAL

A. Cable pull calculations have been performed by the Electrical Engineer of Record to validate 15V cable pulls through the designed conduit system. The Contractor shall use these calculations to support development of a cable pulling plan in compliance with Paragraph 3.2 entitled “Cable Pulling Plan.”

B. Contractor shall hire the services of the Medium Voltage Cable Manufacturer to support development of the “Cable Pulling Plan” and selection of cable pulling techniques and equipment, and to provide training and on-site supervision of medium voltage cable pulls. The factory trained Cable Pull Technician shall have a minimum of 5 years of field experience in medium voltage cabling for similar size projects. The Contractor shall hire the Technician to provide a minimum of 80 man-hours of on-site support and training in cable pulling techniques. Services provided by the Technician shall include two (2) four hour training sessions for the Contractor’s cable pulling crew; training class shall conclude with a written examination of participants. The Technician shall support and witness the first four (4) cable pulls performed by the Contractor; at the end of each cable pull the Technician shall complete and submit a brief report summarizing the cable tension, pulling method and equipment, lubricant application, and other relevant data. Contractor shall submit resume of the factory trained Cable Pull Technician for the Port Construction Representative’s approval 90 days prior to submittal of the Planned Cable Pull outlined in Paragraph 3.2 entitled “Cable Pulling Plan.”

C. Complete cable raceway systems, underground ductbanks, and cable support systems before installing cables. Verify sizing of raceways and pull boxes to ensure proper accommodation for the cables.

D. Check the length of the cable system against the length of cable on the selected reel, or reels. Notify The Port Construction Representative of any inconsistencies.

E. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees F.

F. Where cable terminates in a stress cone, wrap exposed insulation with half-lapped layer of self-fusing silicone tape applied without stretch. Secure ends of silicone tape with vinyl plastic tape to prevent ravel.

G. Damaged cable jacket and/or insulation will be cause for rejection of cable. Do not install cable if jacket is damaged in any way. No kinks are permitted and the bends are to be kept in accordance with the minimums recommended by the Manufacturer. Pull cables directly into the duct from the coil or reel on which they are received. Cable shall not be pulled off and laid on uncovered ground or paved surfaces prior to installation. Make pulls in one direction.

H. Splices are permitted only in locations shown on drawings. Contractor shall pull all cables in continuous lengths unless splices are specified and approved by the Port Construction Representative. Splices are permitted only where indicated on the drawings or approved for connections to existing underground medium voltage feeders. The installer shall be a factory trained and certified technician for such special installation with appropriate splicing kit and materials.
1. Splicing kit shall be 3M QS-III or approved equal, 15 kV Cold Shrink Inline size for cable diameter.
2. Splices shall comply with arcproofing provisions describe in Section 26 60 01 – "Arcproofing."

I. Provide cable lengths with liberal allowances for slack for terminating. If pulling grips are used, sufficient excess cable shall be allowed so that damage due to the pulling grips can be removed prior to terminating. Use rubber tape to seal cable ends. Cable shall not be pulled with the ends open. Where cable requires more than one pull, the Contractor shall lay down new 6 mil PVC plastic sheathing on the ground in the lay down area. The cable shall not be dragged across this surface, but will be permitted to be laid on the surface between pulls. Cable ends shall be moisture proofed at all times until terminations are installed.

J. Provide pull-in guides, cable feeders or draw-in protectors to prevent damage to the cable at the duct mouths. Pull cable by grips on the conductors with proper taping of the insulation to prevent pushback. Short lengths may be pulled with cable grips around the entire group; however, care should be taken to ensure equal distribution of tension and any damaged ends must be cut off and discarded before terminating the cable.

K. Only approved cable lubricants may be used. Cable lubricant shall be Polywater Type J, JP or approved equal. Submit for approval. Cable lubricants must be compatible with the cable’s outer sheath. Refer to the Lubricant Manufacturer’s specifications. Lubricant should be applied according to the Manufacturer’s recommendations. Use an applicator to coat the cable as it enters the duct. Distribute lubricant throughout the innerduct by pulling a swab through the innerduct as part of the pull-line placement process. Pumps or gravity feed devices can also be used to inject lubricant into the duct.

L. Use a GRP Series Kellems grip wire mesh pulling grip or a factory-installed pulling grip and swivel during cable pulls.

M. Use a swivel between the pull-line and pulling grip to prevent the pull-line from imparting a twist to the cable. Use a swivel that contains ball bearings to prevent binding at high tensions.

N. Use a winch with a calibrated maximum tension. A dynamometer or in-line tensionmeter shall be used to monitor tension in the pull-line near the winch. This device must be visible to the Winch Operator or, it shall be used to control the winch. Provide a record of the tension during pulls witnessed by an independent testing agency and present to the Port Construction Representative for review. Submit name of testing agency for approval prior to cable pulling.

O. All pulling equipment and hardware that contacts the cable during installation must maintain the cable’s minimum bend radius. Such equipment includes sheaves, capstans, bending shoes, and quadrant blocks designed for use with MV cable.

P. Long continuous pulls shall be accomplished by hand assisting the cable or, by setting up, intermediate assist winches at bends and at cable access points. Depending upon the type of winch and/or procedure used, the cable may or may not emerge from the manhole at intermediate-assist points. Use of multiple winches requires compatible pulling equipment and coordination of winch speeds. See Section 02582 – “Electrical Manhole and Handhole,” Paragraph 3.1 entitled “INSTALLATION,” Item E for additional requirements.
Q. Long cable pulls, or those involving several bends, may require use of center-pull and “backfeeding” techniques.

R. Unreeling the cable in a “figure-eight” laydown configuration is permitted where laying surface is properly covered to prevent cable sheath damage. Hand tending of the cable paying off from the “figure-eight” is required.

S. “Backfeeding” is permitted to provide a series of shorter, lower-tension pulls in one direction. When backfeeding, pull enough cable out of the manhole to reach the intended end point of the pull, plus racking and splicing slack. Cable should be “figure-eighted” as it emerges from the manhole.

T. Assure adequate cable remains in each manhole for proper cable racking.

3.2 CABLE PULLING PLAN

A. Cable pull calculations have been performed by the Electrical Engineer of Record to validate cable pulls through the designed conduit system. These calculations have been provided as part of the construction documents for the Contractor’s use in developing a cable pulling plan. The Contractor shall submit a cable pulling plan to the Chief Engineer no later than 30 days after completion of the conduit system installation. The Contractor’s cable pulling plan submittal shall include the following information:

1. Brief statement indicating the Contractor has reviewed and understood the cable pull calculations performed by the Electrical Engineer of Record and has installed the conduit system as designed.

2. Should the Contractor have varied from the as-designed conduit system, submit any as-constructed profile variations in conduit system (in AutoCAD format) for the Port Authority’s use in re-calculating cable pulls. The level of detail shown in the submitted as-constructed profile shall equal that of the Issued for Construction plans provided to Contractor.

3. Brief statement acknowledging the Contractor has read and understood the requirements set forth in Paragraph 3.1 entitled “General” of this section.

4. Provide schedule outlining the factory trained Cable Pull Technician’s involvement in preparing the “Cable Pulling Plan” in compliance with Paragraph 3.1 “General” item “B”.

5. Detailed description of the Contractor’s plan for pulling 15 kV cable; explain any changes the Contractor recommends in comparison to the “Planned Cable Pull Site Plan” drawing provided in the construction documents; describe method for handling cable reels and pulling equipment.

6. Provide detailed schedule for cable pulls with manhole number assignments and estimated dates for each pull listed in tabular form.

7. Provide detailed listing of cable pulling equipment (e.g. pulling rope, cable pullers, tuggers, wenches, pulleys, pulling grips, swivels, jack stands, temporary take-up devices, cable reel break, etc.) and tension metering devices; provide make and model of device to be used.

8. Cable pulling equipment setup and pulling methods:
   a. Describe and illustrate equipment setups to be employed at each manhole and/or conduit stub-up.
   b. Describe pulling methods to be employed.
   c. Tabulated list indicating which technique (straight-pull, center-pull, or backfeeding) will be applied at each manhole and/or conduit stub-up.
   d. Dimensional requirements for lay-down of cable.
   e. Protection means to prevent cable sheath damage.
9. Cable lubricant and application method (i.e. swabs, pumps, gravity feed devices.)
10. Calculated optimal lubricant quantity for each cable pull.
11. Cable data listing for each cable size containing weight, outer diameter, and tension rating of cable based on manufacturer’s data.
12. Field measured length of each proposed cable pull.
13. Tabulated list of cable lengths and reel sizes to be ordered for each cable pull planned.
14. Submit as-constructed profile drawings of underground conduit system (in AutoCAD format) for the Port Authority’s use in re-calculating cable pulls.
15. Validate conduit fill, cable configuration, and jam ratio for each cable pull in a tabulated format.
16. Name and contact information of certified testing agency that will witness and certify cable splices and tension metering results.
17. Listing of cable splice kits planned for use and resume of factory trained technician(s) to perform approved splices. Include testing plan compliance with Section 26 08 00.01 – “Medium Voltage System Commissioning Tests,” Paragraph 3.2 entitled “Electrical Tests,” Item G, No. 2.
18. List of safety procedures and protective equipment.
19. Cable pulling plans shall be submitted in electronic Portable Document Format (PDF.)

B. The Contractor will not be allowed to begin cable pulling until the “Cable Pulling Plan” submittal is approved. The submittal will only be approved once the Chief Engineer is satisfied that the Contractor has a comprehensive plan and appropriate equipment in place.

3.3 INSTALLATION

A. Cable in Conduit and Ductbank:

1. Clean conduits of all foreign matter before cables are pulled. Conduit shall be swabbed to ensure debris free. Rubber duct swabs shall be sized to conduit used. Do not exceed cable pulling tensions and bending radius recommended by Cable Manufacturer.
2. Install cables in accordance with the manufacturer’s instructions and the National Electrical Code (NEC). Do not exceed maximum wire tension, maximum insulation pressure, and minimum bending radius.
3. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation.

B. Preparation for Termination:

1. Do not splice medium voltage cable except for approved locations.
2. Make terminations of cables at switchgear and motors using performed stress relief cones rated for phase-to-phase voltage.
3. Indoor terminators shall be equal to Elastimold Type 35MSCI with shield terminator. Outdoor terminators shall be equal to Elastimold 35MTG with shield terminator.
4. Use compression-type terminal lugs and connectors for all sizes of conductors.
5. Use compression-type lugs with long barrel and two-hole tongues, except where terminations space is limited.
6. Electrical tapes shall be equal to those manufactured by 3M as follows:
   a. Fire Retardant Electric Arc Proofing: Scotch 77
   b. Glass Cloth: Scotch 69
c. Self-Fusing Silicone Rubber: Scotch 70

d. Vinyl Plastic: Scotch 88

7. Ground cable shield at each termination.

C. Tests:

1. Before connecting the medium voltage cables, test insulation integrity.
2. Contractor shall employ an electrical testing company with minimum 10 years experience in testing industrial electrical equipment, to perform Megger and Hi Potential test on newly installed cables. Submit name and qualifications of the electrical testing company for review by the Port Construction Representative prior to testing cables.
3. Use a 5 kV DC megohmmeter and perform the cable insulation test in accordance with the operating instructions.
4. Record test data for each cable test and report meggering test complete with signatures of the Port Construction Representative or designated representative who witnesses the testing.
5. If a cable fails tests, the fault shall be located using time domain reflectometry measuring instrument, and all cables in that conduit between the nearest pulling points on each side of the failure shall be withdrawn.

If, in the opinion of the Port Authority, the other cables in the same conduit have not been damaged, they may be reinstated, but the cable, which failed, shall be replaced by new cable. After the replacement of the faulted cable, and any other damaged cables, all cables of the circuit in that conduit shall be retested.

D. Termination:

1. After the cable has been tested with satisfactory results, terminate the medium voltage cable at both ends to designated terminal points.
2. Tighten connection bolts with a torque wrench to specified torque levels.

3.4 TESTING

A. Test cables according to requirements of Section 26 08 00.01 – “Medium Voltage System Commissioning Tests.”

PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 05 19.00 Add – 600-VOLT BUILDING WIRE AND CABLE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for 600-volt building wire and cable.

1.2 REFERENCES


B. Underwriter's Laboratories (UL):
   1. UL 83 - Thermoplastic Insulated Wires and Cables
   3. UL-44 - Electrical Wires, Cables, and Flexible Cords.
   4. UL 486C & D - Splicing Wire Connectors and Standard for Insulated Wire Connector for Use with Underground Conductors.

C. American Society for Testing and Materials (ASTM):
   1. ASTM B3: Soft or Annealed Copper Wires
   2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.

D. Insulated Cable Engineers Association (ICEA):
   1. ICEA S-95-658/NEMA WC 70 - EPR-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and cables the Contractor proposes to furnish, shop drawings and details as may be required by the Port Construction Representative. At the minimum the following are required:

   1. Manufacturer's cut sheets, catalog data
   2. Instruction for handling and storage
3. Dimensions and weight
4. Conformance certificate

C. Submit cable pulling plan in compliance with Paragraph 3.2 entitled “Cable Pulling Plan.”

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All cables shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. Cable shall meet all the requirements of ICEA S-95-658/NEMA WC 70.

C. Submit a conformance certificate signed by the person responsible for product quality. The certificate shall specifically identify the purchased material or equipment; such as by the project name and location, purchase order number, supplements, and item number where applicable, including materials and services provided by others. The certificate shall indicate that requirements have been met and identify any approved deviations.

1.5 DELIVERY, STORAGE AND HANDLING

A. Ship wire and cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by using manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

1.6 MEASUREMENT AND PAYMENT – NEW CONSTRUCTION

A. Payment for “600 Volt Building Wire and Cable” shall be on a unit price lump sum basis for material, labor, and all other incidentals required, complete in place and accepted.

1.7 MEASUREMENT AND PAYMENT – MANHOLE REHABILITATION

A. Payment for ‘Replace Secondary Splices’ shall be on a unit price basis, per Each manhole, for material, labor, equipment, and all other incidentals required, complete in place and accepted.

B. Expected quantities are shown on plan sheet E-169A. Quantities on the bid form may exceed expected quantities to allow for unforeseen conditions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. American Insulated Wire Corporation.

B. Carol Cable Company, Inc.

C. General Cable Company.
2.2 MATERIALS AND EQUIPMENT

A. Design. Provide cable designated as XHHW single conductor type and UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 degrees C in dry locations and 75 degrees C in wet locations where installed in underground duct, conduit or in control panels (MTW).

B. Conductors. Provide conductors that are Class B, concentric stranded, annealed uncoated copper with physical and electrical properties complying with ASTM B3 and B8 and Part 2 of ICEA S-61-402.

C. Insulation. Each conductor shall be PVC insulated to meet the requirements of Part 3 of ICEA S-61-402. The insulation thickness shall match the dimensions listed in Table 310-13 of the National Electrical Code (NEC) for type THHN and THWN wire.

D. Wire Marking:

1. Wire marking shall be in accordance with National Electrical Code (NEC) Article 310-11 and shall be printed on the wire insulation at 2-foot intervals.
2. The printing method used shall be permanent and the color shall sharply contrast with the jacket color.
3. See Section 26 05 53 – “Electrical Identification” for additional requirements.

E. The single conductor color coding shall be as follows:

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>120/208 Volt 3Ph/4w</td>
<td>Black</td>
<td>Red</td>
<td>Blue</td>
<td>White</td>
</tr>
<tr>
<td>120/240 Volt 3Ph/4w</td>
<td>Black</td>
<td>Orange</td>
<td>Blue</td>
<td>White</td>
</tr>
<tr>
<td>277/480 Volt 3Ph/4w</td>
<td>Brown</td>
<td>Purple</td>
<td>Yellow</td>
<td>Grey</td>
</tr>
<tr>
<td>Motor Control</td>
<td>1</td>
<td>Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground</td>
<td></td>
<td></td>
<td></td>
<td>Green</td>
</tr>
<tr>
<td>120/240 Volt 1Ph/3W</td>
<td>Black</td>
<td>Red</td>
<td></td>
<td>White</td>
</tr>
</tbody>
</table>
PART 3  EXECUTION

3.1  GENERAL

A.  Cable pull calculations have been performed by the Electrical Engineer of Record for the worst-case condition as a general validation of the designed conduit system. The Contractor shall use these calculations to support development of a cable pulling plan in compliance with Paragraph 3.2 entitled “Cable Pulling Plan.”

B.  Complete cable raceway systems, underground ductbanks, and cable support systems before installing cables. Verify sizing of raceways and pull boxes to ensure proper accommodation for the cables.

C.  Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees Fahrenheit.

D.  Splices are not permitted for new cable pulls Contractor shall pull all cable in continuous lengths unless splices are specified or approved by the Port Construction Representative.

E.  Check the length of the cable raceway system against the length of cable on the selected reel. Provide cable lengths with liberal allowances of slack for terminating. If pulling grips are used, sufficient excess cable shall be allowed so that damage due to the pulling grips can be removed prior to terminating. Use rubber tape to seal cable ends. Cable shall not be pulled with the ends open. Where cable requires more than one pull, the Contractor shall lay down new 6 mil PVC plastic sheathing on the ground in the lay down area. The cable shall not be dragged across this surface, but will be permitted to be laid on the surface between pulls. Cable ends shall be moisture proofed at all times until terminations are installed.

F.  Use a swivel between the pull-line and pulling grip to prevent the pull-line from imparting a twist to the cable. Use a swivel that contains ball bearings to prevent binding at high tensions.

G.  Use a winch with a calibrated maximum tension. A dynamometer or in-line tensionmeter shall be used to monitor tension in the pull-line near the winch. This device must be visible to the Winch Operator or, it shall be used to control the winch. Provide a record of the tension during pulls witnessed by an independent testing agency and present to the Port Construction Representative for review.

H.  All pulling equipment and hardware that contacts the cable during installation must maintain the cable’s minimum bend radius.

I.  Long continuous pulls shall be accomplished by hand assisting the cable or, by setting up, intermediate assist winches at bends and at cable access points. Depending upon the type of winch and/or procedure used, the cable may or may not emerge from the manhole at intermediate-assist points.

J.  Long cable pulls, or those involving several bends, may require use of center-pull and “backfeeding” techniques.
K. Unreeling the cable in a “figure-eight” laydown configuration is permitted where laying surface is properly covered to prevent cable sheath damage. Hand tending of the cable paying off from the “figure-eight” is required.

L. “Backfeeding” is permitted to provide a series of shorter, lower-tension pulls in one direction. When backfeeding, pull enough cable out of the manhole to reach the intended end point of the pull, plus racking and splicing slack. Cable should be “figure-eighted” as it emerges from the manhole.

M. Assure adequate cable remains in each manhole for proper cable racking.

3.2 CABLE PULLING PLAN

A. Cable pulling calculations have been performed by the Electrical Engineer of Record for the worse cable condition as a general validation of the designed conduit system. These calculations have been provided as part of the construction documents for the contractor’s use in developing a cable pulling plan. The Contractor shall submit a cable pulling plan to the Port Construction Representative no later than 30 days after completion of the conduit system installation. The Contractor’s cable pulling plan submittal shall include the following information:

1. Brief statement acknowledging the Contractor has read and understood the requirements set forth in Paragraph 3.1 entitled “General” of this section.
2. Detailed description of the Contractor’s plan for pulling 600-volt cable; explain any changes the Contractor recommends in comparison to the “Planned Cable Pull Site Plan” drawing provide in the construction documents; describe method for handling cable reels and pulling equipment.
3. Provide detailed schedule for cable pulls with manhole number assignments and estimated dates for each pull listed in tabular form.
4. Provide detailed listing of cable pulling equipment (e.g. pulling rope, cable pullers, tuggers, wenches, pulleys, pulling grips, swivels, jack stands, temporary take-up devices, cable reel break, etc.) and tension metering devices; provide make and model of device to be used.
5. Cable pulling equipment setup and pulling methods:
   a. Describe and illustrate equipment setups to be employed at each manhole and/or conduit stub-up.
   b. Describe pulling methods to be employed.
   c. Tabulated list indicating which technique (straight-pull, center-pull, or backfeeding) will be applied at each manhole and/or conduit stub-up.
   d. Dimensional requirements for lay-down of cable.
   e. Protection means to prevent cable sheath damage.
6. Cable lubricant and application method (i.e. swabs, pumps, gravity feed devices.)
7. Calculated optimal lubricant quantity for each cable pull.
8. Cable data listing for each cable size containing weight, outer diameter, and tension rating of cable based on manufacturer’s data.
9. Field measured length of each proposed cable pull.
10. Tabulated list of cable lengths and reel sizes to be ordered for each cable pull planned.
11. Submit as-constructed profile drawing of underground conduit system (in AutoCAD format) for the Port Authority’s use in re-calculating cable pulls.
12. Validate conduit fill, cable configuration, and jam ratio for each cable pull in a tabulated format.
13. Name and contact information of certified testing agency that will witness and certify tension metering results.
14. List of safety procedures and protective equipment.
15. Cable pull plan shall be submitted in electronic Portable Document Format (PDF.)

B. The Contractor will not be allowed to begin cable pulling until the “Cable Pulling Plan” submittal is approved. The submittal will only be approved once the Port Construction Representative is satisfied that the Contractor has a comprehensive plan in place.

3.3 INSTALLATION

A. Wiring Methods:

1. Use wiring methods indicated on the Drawings
2. In general, use THHN/THWN or XHHW building wire for lighting, power and control wiring where conductors are enclosed in raceways such as above ground conduit system or in underground ductbanks, or inside control panels.
3. Do not use solid conductors.
4. Minimum size of conductors shall be No. 12 AWG stranded for lighting circuits.
5. Minimum size of conductor shall be No. 14 AWG for control circuits, except when part of a multiconductor cable or internal panel wiring and telephone wiring.
6. Do not splice conductors unless approved by the Port Construction Representative or Port of Houston Authority’s Representative in writing.
7. Splices associated with taps for lighting and control circuits are allowed without approval. Make splices in accessible junction boxes.
8. Wire nuts are not to be used for wiring splices. Splice circuits with proper insulated compression connectors.

B. Single Conductor in Conduit and Ductbank:

1. Install cables in accordance with the manufacturer’s instructions and the National Electrical Code (NEC), Chapter 3- Wiring Methods and Materials. Do not exceed maximum wire tension, maximum insulation pressure, and minimum bending radius.
2. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation.

C. Single Conductor in Cable Tray:

1. Do not install single conductor building wire and cable in cable tray.
2. For single conductor tray installation, see requirements of plans and specifications.

D. Preparation for Termination:

1. Make 600-volt power cable terminations and splices with heat shrinkable sleeves and seals.
2. Terminal lugs and connectors for all sizes of conductors shall be compression type.
3. For size 1/0 AWG and larger, compression lugs shall have the long barrel with two-hole tongues except in places where termination space is limited.
E. Solderless Connectors And Terminals

1. Acceptable Manufacturers:
   a. American Pamcor.
   b. 3M.
   c. Burndy.
   d. Thomas and Betts.
   e. Ideal.
   f. Nepco
   g. O-A/Gedney
   h. Or approved substitution

2. Materials and Equipment:
   a. Systems Above 50 Volts A.C. Up to 600 Volts A.C.:
      1) Terminations of solid wires of No. 10 AWG and smaller at screw terminals shall be made by forming the wires in a ring to fit under a screwhead, thus requiring no terminal lug.
      2) Termination of No. 8 AWG stranded cable at screw terminals only shall be made by using 3M E-01 Series, or approved substitution, pressure-crimp, vinyl insulated, ring-tongue terminals.
      3) Interior location splices and taps in wire No. 8 AWG and smaller, shall be made with approved, insulated spring connectors. Use 3M Scotchloks, or approved substitution.
      4) Exterior location splices and taps in wires 2 No. 6 AWG and less, shall be made with approved, insulated twist-on spring connectors containing a silicone gel installed at the factory to afford a complete waterproof splice. Use King Technology “King Connectors,” or approved substitution.
      5) Terminations of No. 6 AWG and larger wires shall be made using solderless, mechanical connectors. Except as otherwise indicated or specified, all solderless connectors shall be of the combination set-screw and pressure plate type and shall have cast copper alloy bodies with brass screws and copper alloy pressure plates. Connectors shall be O/Z-Gedney Type XL or XLH, or approved substitution. The above shall not apply to factory-assembled equipment such as molded case circuit breakers and disconnect switches, which are furnished with non-replaceable lugs.
      6) Solderless connectors shall be provided with one mounting hole for #2 AWG wire and smaller and with two mounting holes for #1/0 AWG wire and larger.
      7) Use proper size brass or bronze bolts, and hardware of Burndy Durium alloy, or approved substitution, for bolting cable terminations to equipment terminals and bus bars.
      8) For splicing of cable No. 6 AWG and larger, provide O/Z-Gedney, or approved substitution, Type XW, combination type two-way connectors. Connectors shall have cast alloy bodies, with brass screws and copper alloy pressure plates. Provide O/Z Gedney, or approved substitution, Type XWC insulating covers to enclose splices.
      9) For taps off No. 6 AWG cable and larger provide O/Z-Gedney combination Type PMX parallel taps with type PMXC insulating covers or combination Type XTP parallel and “T” taps with Type XTPC covers.
b. System 50 Volts A.C. and Below:
   1) Provide Scotchlok B-01 or C-01 Series, pressure-crimp, vinyl-
      insulated, ring-tongue terminals by 3M, or approved substitution,
      for all terminations.
   2) In locations where splicing of stranded wire is indicated or
      required use B-42 or C-42 Series, vinyl-insulated, butt splices by
      3M, or approved substitution.
   3) Taps in stranded wire may be made with pressure crimp
      connectors, or approved substitution, except that the conductor
      being tapped shall not be cut, and shall be twisted together with
      the tap conductor before being inserted into the connector.
   4) Wire terminals shall be installed with pressure tools such as
      those manufactured by American Pamcor No. 59072, or
      approved substitution, which obliges the Electrician to apply
      the correct pressure required to produce a tight connection before
      the tool is released. Use a pressure tool designed for
      the specified size of connector and wire being terminated.

F. Tape:

1. Acceptable Manufacturers:
   a. 3M.
   b. Plymouth.
   c. Or approved substitution.

2. Materials and Equipment:
   b. Plastic Electrical Insulating Tape for General Use. Vinyl plastic with
      rubber-based pressure-sensitive adhesive. Pliable at temperature of
      minus 18 degrees C to 105 degrees C. When tested in accordance with
      ASTM D 3005, the tape shall have the following minimum properties.
      1) Thickness: 7 mils.
      2) Breaking Strength: 15 pounds per inch.
      3) Elongation: 200 percent.
      4) Dielectric Strength: 10,000 volts/mil.
      5) Insulation Resistance (Direct method of electrolytic corrosion): 1,000,000 megohms.
   c. Rubber Electrical Insulating Tape for Protective Overwrapping: Silicone
      rubber with a silicone pressure-sensitive adhesive. When tested in
      accordance with ASTM D1000, the tape shall have the following
      minimum properties:
      1) Thickness: 15 mils.
      2) Tensile Strength: 11 pounds per inch.
      3) Elongation: 525 percent.
      4) Dielectric Strength: 13,000 volts.
      5) Insulation Resistance (Indirect Method of Electrolytic Corrosion): 1,000,000 megohms.
   d. Arcproof Tape: Flexible, conformable organic fabric, coated one side
      with a flame-retardant flexible elastomer-self-extinguishing, with the
      following minimum properties:
      1) Thickness: ASTM D1000; 55 mils.
      2) Tensile Strength: ASTM D1682; 50 pounds per inch.
3) Thermal Conductivity: ASTM D1518; 0.0478 btu/hour/square foot/degrees F.


e. Shelf Life: Mark each tape package to indicate shelf-life expiration date.

f. Glass Cloth Electrical Insulating Tape (For Use With Arcproof Tape): Woven glass fabric, when tested in accordance with ASTM D1000, the tape shall have the following minimum properties:

1) Thickness: 7 mils.
2) Breaking Strength: 170 pounds per inch.
3) Elongation: 5 percent.
4) Dielectric Breakdown: 2,500 volts.
5) Insulation Resistance (Indirect Method of Electrolytic Corrosion): 5,000 megohms.

G. Tests:

1. In general, test insulation integrity of the wiring system before terminating.
2. Make sure to disconnect sensitive electronic equipment before testing insulation.
3. Use a 500 VDC megohmmeter and perform the wire system insulation test in accordance with the operating instructions.
4. Tests are to be performed in compliance with Section 26 08 00 – “Field Testing” and NETA Acceptance Testing Specifications.

H. Termination: After the 600-volt wiring system has been tested with satisfactory results, reconnect wire.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 05 23.00 Add – 600 VOLT CONTROL CABLE

PART 1 GENERAL

1.1 DESCRIPTION

A. Subject to the General and Special Conditions, this Section includes specifications for 600-volt control cable.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM B3 - Soft or Annealed Copper Wires
   2. ASTM B8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft
   3. ASTM B33 - Tinned Soft or Annealed Copper Wire for Electrical Purposes
   4. ASTM B174 - Bunch-stranded Copper Conductors for Electrical Conductors

B. Institute of Electrical and Electronics Engineers (IEEE): IEEE 383-2.5 - IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.

C. Insulated Cable Engineers Association (ICEA): ICEA S-96-658/NEMA WC 70 - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-8)

D. Underwriters' Laboratories (UL):
   1. UL 44: Rubber Insulated Wires and Cables
   2. UL 83: Thermoplastic Insulated Wire and Cables

E. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No. 70 - National Electrical Code (NEC), Chapter No. 3 - Wiring Methods and Materials, Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be

CSP Date: April 1, 2014 26 05 23.00 Add 600 VOLT CONTROL CABLE Page - 1
required by the Port Construction Representative. At the minimum, the following are required.

1. Completed manufacturer's data sheets.
2. Manufacturer's cut sheets, catalog data.
3. Installation, terminating and splicing procedure.
4. Instruction for handling and storage.
5. Dimensions and weight.
6. Conformance certificate.

1.4 QUALITY ASSURANCE

A. All work, equipment and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. Cable shall be tested at the factory to confirm that the cable complies with requirements of ICEA S-95-658/NEMA WC 70.

1.5 DELIVERY STORAGE AND HANDLING

A. Ship cable on manufacturer's standard reel sizes, unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

1.6 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Alpha Wire Corporation

B. Belden Division, Cooper Industries, Inc.

C. Cablec Continental Cables Company

D. General Cable Company

E. Okonite Company

2.2 MATERIALS AND EQUIPMENT

A. Design: Provide cable with the following design characteristics. The cable shall consist of multiple conductors. The cable assembly shall be UL listed, flame, oil and sunlight resistant, and certified for continuous operation at the temperature specified in
Manufacturer’s data sheet in wet or dry locations where installed in underground duct, conduit, or cable tray. The number and size of conductors supplied in each cable shall correspond to the quantities required for the purpose plus 25 percent spares.

B. Conductors: Provide conductors, with concentric or bunch-stranded, annealed tinned copper with physical and electrical properties conforming to ASTM B3, B8 or B33 or B174 and ICEA S-95-658/NEMA WC 70 unless otherwise specified.

C. Insulation: Each conductor shall be insulated in compliance the requirements of ICEA S-61-402, S-66-524 or S-68-516. The average insulation thickness shall not be less than the dimensions shown in ICEA S-95-658/NEMA WC 70 for 600-volt insulation.

D. Jacket:
   1. When control cables are to be enclosed in conduit, ducts or in other raceway systems, the cables shall be of the non-metallic type and shall be covered by an overall nonmetallic jacket, which complies with the requirements of ICEA S-95-658/NEMA WC 70.
   2. Multi-conductor cables shall have a jacket thickness, which complies with ICEA S-95-658/NEMA WC 70.

E. Armor: Where control cables are to be exposed such as in cable tray, cable channel or other cable support systems, the cables shall be protected by an interlocked metal tape armor made of galvanized steel, which meets the requirements of ICEA S-95-658/NEMA WC 70. An over-all jacket shall be provided.

F. Conductor Identification: Identify individual conductors in conformance with ICEA S-95-658/NEMA WC 70.

G. Cable Marking: Print cable-marking information on the jacket of each cable at 2-foot intervals. Use a permanent printing method with a color sharply contrasting the jacket color.

H. Terminal Devices: Provide wiring terminal and cable lugs of adequate size and quantity to accommodate all of the required conductors and cables.

PART 3 EXECUTION

3.1 GENERAL

A. When control wiring requires installation in cable tray and other cable support systems, use the 600-Volt Multiconductor Control Cable.

B. Complete cable raceway systems, underground duct banks, and cable support systems before installing cables.

C. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.

D. Check the length of the cable raceway system against the length of cable on the selected reel.

E. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees F.
F. Provide at least 25 percent spare conductors.

3.2 INSTALLATION

A. Cable in Conduit and Ductbank:

1. Clean conduits of all foreign matter before cables are pulled in.
2. Install cables in accordance with the manufacturer's instructions and the National Electrical Code (NEC), Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling and Power Limited Circuits. Do not exceed maximum wire tension, maximum insulation pressure, and minimum bending radius.
3. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation or cable jacket.

B. Preparation for Termination:

1. Do not splice conductors unless approved by the Port Construction Representative in writing. For termination use crimp-on or compression type, ring tongue, non-insulated, tin-plated copper lugs.
2. Mark wiring on both ends with circuit numbers or loop tag numbers. Heat shrink wire markers after the ring tongue terminal has been installed. Extend the marker over the crimp-on base of the terminal.

C. Tests:

1. Test insulation integrity and conductor continuity before connecting the cables.
2. Use a 500 VDC megohmmeter and perform the cable insulation test in accordance with the operating instructions.
3. Megger tests are to be done in the presence of the inspector and test results submitted to the Port Construction Representative.
4. Tests are to be performed in compliance with Section 26 08 00 – “Field Testing” and NETA Testing Specifications.

D. Termination:

1. After the 600-volt control cable has been tested with satisfactory results, terminate the cable at both ends to designated terminal points.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for the following.

1. Grounding electrodes and conductors.
2. Equipment grounding conductors.
4. Power system grounding.
5. Communication system grounding.
6. Electrical equipment and raceway grounding and bonding.
7. Control equipment grounding.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM B3 - Soft or Annealed Copper Wires.
   2. ASTM B8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
   3. ASTM B33 - Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Institute of Electrical and Electronics Engineers (IEEE):

C. Underwriters' Laboratories (UL):
   1. UL 83 - Thermoplastic Insulated Wire and Cables.
   2. UL 467 - Grounding and Bonding Equipment.


F. Port of Houston Authority Codes.
1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At minimum, the following are required.

   1. Manufacturer’s literature and catalog data.
   2. Installation, terminating and splicing procedure.
   3. Instruction for handling and storage.
   4. Dimensions and weight.

C. For manholes and handholes, submit detail of wiring and termination arrangements showing conductor sizes and ground rod location.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY, STORAGE AND HANDLING

A. Ship grounding cable on manufacturer’s standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Pack and crate other materials specified to withstand normal abuse during shipping, handling, and storage.

1.6 MEASUREMENT AND PAYMENT – NEW CONSTRUCTION

A. Payment for “Grounding and Bonding” shall be on a lump sum basis for all material, labor, and other incidentals required, complete in place and accepted.

1.7 MEASUREMENT AND PAYMENT – MANHOLE REHABILITATION

A. Payment for ‘Repair Grounding’ shall be on a unit price basis, per Each manhole, for material, labor, equipment, and all other incidentals required, complete in place and accepted.

B. Expected quantities are shown on plan sheet E-169A. Quantities on the bid form may exceed expected quantities to allow for unforeseen conditions.
PART 2  PRODUCTS

2.1  ACCEPTABLE MANUFACTURERS

A.  Cable:
   2. General Cable Company.
   3. Okonite Company.
   4. Triangle Wire and Cable, Inc.
   5. Or approved substitution.

B.  Ground Rods and Connectors:
   1. Blackburn.
   2. Copperweld.
   3. Thomas & Betts.

C.  Exothermic Connections:
   1. Burndy Corporation (Therm-O-Weld).
   2. Erico Products (Cadweld).

D.  Grounding Connectors:
   1. Burndy Corporation.
   2. O.Z. Gedney.
   3. Thomas & Betts.

2.2  MATERIALS AND EQUIPMENT

A.  Design:  Provide grounding cable and materials with the following characteristics:
    Grounding system shall be designed in accordance with NEC Article No. 250 -
    Grounding, and the IEEE 142-82 - Recommended Practice for Grounding of Industrial
    and Commercial Power Systems.

B.  Materials:
    1. Use grounding conductors, bare or insulated, as specified in drawings, which are
       manufactured and tested in accordance with applicable standards ASTM B3,
       ASTM B8 and ASTM B33.
    2. Provide a main ground loop of size indicated on drawings, Class C stranded bare
       copper cable. Small groups of isolated equipment may be grounded by a smaller
       insulated conductor connected to the main loop. Generally, where not otherwise
       indicated, taps shall be sized as follows:
       a. Switchgear, motor control centers and power transformers   #4/0
       b. Motors 200 hp and above                                    #4/0
       c. Power panels - AC and DC                                   #2/0
       d. Control panels and consoles                               #2
       e. Building columns                                           #4/0
       f. Fencing posts                                              #2/0
       g. Fencing posts on concrete traffic barriers                 #2/0
C. Where single conductor insulated grounding conductors are called for, use 600-volt insulation. Use ground conductors identified with green insulation or green tape marking.

D. Supply identifying ribbon which is PVC tape, 3 inches wide, red color, permanently imprinted with "CAUTION BURIED ELECTRIC LINE BELOW" in black letters as specified in Section 26 05 53, Electrical Identification.

E. Utilize flexible copper braid across hinged chain link or fence gates to bond the movable portion to the grounded fence post.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete site preparation and soil compaction before trenching and driving ground rods for the underground grid.

B. Verify from Drawings the exact location of stub-up points for grounding of equipment, fences and building or steel structures.

C. See drawings for power and communications manhole and handhole drawings and conform to requirements shown.

3.2 CONSTRUCTION CRITERIA

A. Install the main ground loop at a depth as indicated on drawings. Connect the ground loop to ground rods and to tap connections to form a complete system as indicated on the electrical Drawings. The Contractor shall give special attention to the grounding of service equipment, structures, and fences to comply with the NEC, local authorities and the serving utility company.

B. Electrical equipment, buildings, tanks, and other structures and equipment shall be grounded as indicated on the Drawings. Where ground rods are required, the rods shall be 10 feet long, 3/4 inch diameter, copper-clad steel ground rods. Rods shall be driven vertically, and the top of the rods shall be a minimum of 18 inches below finished grade, or as specified on the Drawings. Install additional ground rods if necessary to obtain a ground resistance less than 5-ohms.

C. Local pushbutton and selector switch stations, two-wire control devices, disconnect switches, lighting transformers, panelboards, operator panels, benchboards, and the enclosures of other electrical apparatus shall be grounded through and equipment grounding conductor run with the power supply or control circuit conductors or shall be grounded as shown on the Drawings.

D. Motors having power supplied by multiconductor cable shall be grounded by a separate grounding conductor in the cable and where supplied by single conductor cable in conduit by a grounding conductor pulled in the conduit. Connect ground conductors to the ground bus in the motor control center and to the ground terminal provided in the motor conduit box.

E. Install a red warning ribbon approximately 12 inches below finished grade directly above the ground grid.
F. Connect fence posts of chain link and metal fences to the main ground loop at least every 50 feet.

3.3 INSTALLATION

A. Equipment Grounding:

1. Make grounding connections to surfaces, which are dry and cleaned of paint, rust, oxides, scales, grease, and dirt to ensure good conductivity. Clean copper and galvanized steel to remove oxide before making welds or connections.
2. Use the exothermic welding process for below-grade grounding connections, except at ground rods. Use mechanical connectors or thermal connections for above-grade grounding connections as shown on the Drawings.
3. Make grounding connections to electrical equipment, vessels, mechanical equipment and ground rods in accordance with the Drawings.
4. Ground tanks and vessels by making connections to integral structural supports or to existing grounding lugs or pads, and not to the body of the tank or vessel.
5. Leave ground connections to equipment visible for inspection. Protect them with PVC non-metallic conduit as indicated on the Drawings.
6. Make connections to motor frames and ground buses with lugs attached to the equipment by means of bolts. Do not use motor anchor bolts or equipment housing for fastening lugs of grounding cable.
7. Where the wiring for lighting systems consists of single conductor cables in conduit, provide each conduit with an equipment grounding conductor. Use a grounding conductor with green colored insulation and ground equipment in the lighting system.

B. Raceway and Support Systems Grounding:

1. Install raceway, cable rack and conduit so that it is bonded together and permanently grounded to the equipment ground bus, according to the Drawings. Connection to conduit may be grounding bushing or ground clamp.
2. Install raceway at low voltage control equipment so that it is bonded and grounded, except that any conduit which is effectively grounded to the sheet metal enclosure by bonding bushing or hubs need not be otherwise bonded.
3. Where a grounding conductor is run near cable rack arm, bond the grounding conductor to each section of cable rack arm with a cable tray ground clamp.
4. Where only grounding conductor is installed in a metal conduit, bond both ends of the conduit to the grounding conductor.
5. Provide flexible "jumpers" around raceway expansion joints. Use copper bonding straps for steel conduit. Install jumpers across cable tray joints, which have been parted to allow for expansion and any hinged cable tray connections.

C. Fences and Gates: Ground fences, fence posts, and gates to the underground grid as shown on the Drawings.

D. Power System Grounding:

1. Solidly ground the secondary neutral of the main power supply transformer either to the ground grid or through an impedance. See Drawings for details.
2. Solidly ground the neutral of lighting, instrument and control transformers.
E. Cable Armor and Shields:

1. For shielded control cable, terminate and ground the shield at one end only, preferably at the control panel end for instrument and communication cable and at the supply end for electronic power cables. Maintain shield continuity by jumpering the ground shield across connection point where it is broken at junction boxes, or other splice points. Insulate these points from ground.

2. Connect the ground wire in power cable assemblies at each terminal point to a ground bus, if available, or to the equipment enclosure. Do not carry these ground wires through a "doughnut" current transformer (CT) used for ground fault relaying; do carry ground leads from stress cones through CT's. Ground power cable armor and shield at each terminal point.

F. Test Wells:

1. Provide access (test wells) for testing the ground grid system at one or several ground rod locations. Make test wells of a pipe surrounding the rod and connections with a cover placed on top at grade level. See Drawings for details.

3.4 TEST

A. Perform ground resistance tests after underground installation and connections to building steel are complete, unless otherwise noted on applicable Drawings.

B. Make tests at each ground test well using a "fall of potential" test method. Each ground test well shall not exceed a maximum resistance of 5 ohms. Where measured values exceed this figure, install additional ground rods as required to reduce the resistance to the specified limit.

C. Submit test reports to Port Construction Representative.

D. Tests shall comply with standards established in the NETA Acceptance Testing Specifications.

3.5 INSPECTION

A. Inspection of the grounding system by the Port Construction Representative must take place before the grid trenches are backfilled.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 05 29.00 Add – SUPPORTING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes specifications for the following:

1. Conduit and equipment supports.
2. Anchors and fasteners.
3. Strut.
4. Fittings.
5. Hangers.
6. Hanger rod.
8. Cable ties.
10. Concrete Equipment Pads.

1.2 REFERENCES


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Provide strut by no more than two (2) manufacturers.

C. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

D. Shop drawings indicating details of fabricated products and materials.

E. Submittals in this section shall be sealed by a licensed Structural Engineer in the State of Texas and/or System Building Manufacturers, where applicable.

1.4 QUALITY ASSURANCE

A. Comply with the following:

1. Electrical components shall be listed and labeled by UL, ETL or CSA.
1.5 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

1. Slotted Metal Angle and U-Channel Systems:
   a. Allied Tube & Conduit
   b. American Electric
   c. B-Line Systems, Inc.
   d. GS Metals Corp.
   e. Unistrut Corporation

2. Hangers:
   a. Erico/Caddy
   b. Allied
   c. American Electric
   d. B-Line
   e. GS Metals
   f. Unistrut

3. Brackets:
   a. Erico
   b. Bowers
   c. Raco
   d. Steel City

4. Vibration Isolators:
   a. Amber/Booth
   b. Dynasonic
   c. Grinnell
   d. Mason Industries

2.2 COATINGS

A. Coating: Strut, fittings, hangers, and hanger rod shall be ASTM A123 hot dip galvanized after fabrication. Hardware fasteners and clamps shall have ASTM B633 Type III SCI electroplated zinc coatings.

2.3 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, hot dipped malleable iron clamps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps. Purlin hangers shall mount to the vertical member of the purlin or as otherwise required by building manufacturer and/or structural engineer.

B. Fasteners: Types, materials, and construction features as follows:

1. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using beam clamps.
2. Use steel springhead type toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

3. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

4. Do not use powder-actuated anchors.

5. Do not drill structural steel members.

C. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color-coding.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non- armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems (Strut): 12-gage steel 1-5/8 inch x 1-5/8 inch minimum channels, with 9/16 inch x 1-1/8 inch maximum short slots at 2 inch on center maximum. Strut shall be cold formed per ASTM A570 GR33. Joints in strut system shall be made with four bolt accessories as a minimum. Conduit clamps to strut shall be bolt using Unistrut 1100, 1200, or 1400 Series, or approved substitution.

F. Recessed Box Supports Brackets: Mount boxes with Erico/Caddy SGB Series, FBS Series or approved substitution.

2.4 FIELD FABRICATED SUPPORTING DEVICES

A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
   a. 3 inches and smaller: 20-gage.
   b. 4 inches to 6 inch: 16-gage.
   c. Over 6 inches: 14-gage.
2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

D. All Thread Rod: Hot dip galvanized, 1/4 of an inch minimum.

2.5 VIBRATION ISOLATORS

A. Hangers: Spring steel hangers shall be amber/booth BS Series or approved substitution.

B. Pads: Provide ribbed neoprene pads amber/booth Type NR or approved substitution.
PART 3 EXECUTION

3.1 GENERAL

A. Install supporting devices to fasten electric components securely and permanently in accordance with NEC, NECA, and manufacturers requirements.

B. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts, or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams, or to a depth of more than 3/4 of an inch in concrete, shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration-resistant and shock-resistant fasteners for attachments to concrete slabs.

C. Exclusions:

1. Do not fasten supports to ceiling system, pipes, ducts, mechanical equipment, and conduit.

2. Tie wires and perforated pipe straps shall not be used for securing conduits.

3. Do not support loads from the bottom chord member of trusses or open web steel joists.

4. Do not attach conduit to ceiling support wires or ceiling tees.

5. Do not use powder-actuated anchors unless indicated by Architect or Structural Engineer.

6. Do not drill or cut structural members unless directed by Architect or Structural Engineer.

D. Touch up all scratches or cuts on steel components with an approved zinc chromate or 90 percent zinc paint. Use PVC compounds on PVC coated components.

3.2 CONDUIT, RACEWAYS AND SLEEVES

A. Fabricate supports form structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts unless otherwise noted.

B. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.

C. Install individual and multiple raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
D. Support parallel runs of horizontal raceways together on trapeze-type hangers. Where conduit is of different sizes, use the same trapeze hanger space supports for the smallest size conduit on the rack.

E. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for raceways 1 inch in diameter or smaller, serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use threaded steel with a diameter of 1/4 of an inch or larger. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

F. Branch circuit raceways, which are 1 inch in diameter or smaller, may be attached to wall studs using manufactured clips.

G. Space supports for raceways in accordance with NEC.

H. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

I. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire-rated wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

3.3 BOXES AND WIRING DEVICES

A. Structural Mounting: They shall be rigidly supported from a structural member of the building either directly or by using a metal brace. Support wires that do not provide rigid support shall not be permitted as the sole support.

B. Outlet or junction boxes in exposed or concealed ceilings, all thread rod, manufactured brackets shall be mounted to building structure, strut suspended from building structure. Do not support boxes with conduit only or with all thread rod.

C. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

D. Support boxes independently of conduit, except for a cast box that is connected to two rigid metal conduits, both of which are supported within 12 inches of the box.

E. Use stamped steel bridges to fasten flush mounting outlet box between studs.

F. Metal braces shall be protected against corrosion and formed from metal not less than 0.020 inch (508 micrometers) thick uncoated.

G. Use adjustable steel channel fasteners for hung ceiling outlet box.

H. Do not fasten boxes to ceiling support wires or tees.

3.4 WIRES AND CABLES

A. Vertical Conductor Supports: Install simultaneously with installation of conductors.
3.5 INDOOR AND OUTDOOR WALL MOUNTED EQUIPMENT

A. This shall include but not be limited to cabinets, enclosures, disconnect switches, panelboards, motor controllers, small transfer switches, and wireways.

B. All cabinets and panelboards shall be wall mounted unless otherwise indicated.

C. Install surface-mounted cabinets and panelboards with minimum of four anchors.

D. In wet and damp locations use steel channel supports to stand cabinets and panelboard one inch off wall.

E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

3.6 INDOOR FLOOR MOUNTED EQUIPMENT

A. This shall include but not be limited to switchboards, dry type transformers, and motor control center.

B. Freestanding equipment shall be installed on concrete pads unless noted otherwise.

C. Concrete pads shall be 3 inches tall and shall be 2 inches wider than equipment on all four sides.

D. Concrete shall be 3000 PSI, 28-day compressive strength.

E. Concrete, forms, and reinforcing shall be in accordance with Division 3.

F. Floor mounted transformers shall also be provided with neoprene vibration isolation pads.

3.7 INDOOR SUSPENDED EQUIPMENT

A. Equipment to be suspended shall be supported with strut, with all thread rod and beam clamps.

B. Transformers shall also have spring steel hanger vibration isolators.

3.8 INDOOR AND OUTDOOR RACK OR PEDESTAL MOUNTED EQUIPMENT

A. Equipment shall be rack or pedestal mounted only where indicated or required by installation.

B. Mount on strut bolted to concrete or anchored with concrete base when located outside.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes basic requirements specifically applicable to the work of Division 26 – Electrical. This Section includes specifications for conduit, fittings, and bodies.

1.2 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C 80.1 - Rigid Steel Conduit - Zinc Coated.
   2. ANSI C 80.4 - Fittings for Rigid Metal Conduit.

B. Federal Specifications (FS):
   1. FSW-C-58 C - Conduit Outlet Boxes, Bodies Aluminum, and Malleable Iron.
   2. FSW-C-1094 - Conduit and Conduit Fittings Plastic, Rigid.
   3. FSWW-C-581-D - Coating on Steel Conduit

C. National Electrical Manufacturers Association (NEMA):
   1. NEMA RN 1 - Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.
   2. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
   3. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

D. National Fire Protection Association (NFPA):
   1. ANSI/NFPA 70 - National Electrical Code (NEC).
      a. NEC Article 344.24.
      b. NEC Article 346-11.
      c. NEC Article 346-15.

E. Port of Houston Authority Electrical Code.

F. Underwriters’ Laboratories (UL):
   1. UL 6 - Rigid Metal Electrical Conduit.
   2. UL 514 B - Fittings for Conduit and Outlet Boxes.
   3. UL 651 - Schedule 40 and 80 Rigid PVC Conduit.
   4. UL 651 A - Type EB and A Rigid PVC Conduit and HDPE Conduit.
1.4 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following are required:
   1. Manufacturer's cut sheets, catalog data, and sizes.
   2. Installation, terminating and splicing procedure.
   3. Instruction for handling and storage.
   6. Conformance certificate.

1.5 QUALITY ASSURANCE

A. Protection: All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. Rigid steel conduit shall pass the bending, ductility, and thickness of zinc coating tests described by ANSI C 80.1.

C. Flexible conduit shall pass the tension, flexibility, impact, and zinc coating test described by UL 1.

D. Nonmetallic conduit and fittings shall pass the test requirements of NEMA TC 2, UL 651 and 651 A.

1.6 DELIVERY STORAGE AND HANDLING

A. Package conduit in 10-foot bundles maximum with conduit and coupling thread protectors suitable for indoor and outdoor storage. Package fittings in manufacturer's standard quantities and packaging suitable for indoor storage. Package plastic-coated rigid conduit, fittings, and bodies in such a manner as to protect the coating from damage during shipment and storage.

B. Store conduit above ground on racks to prevent corrosion and entrance of debris.

C. Protect plastic conduit from sunlight.
PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Rigid Steel Conduit:
   1. Allied Tube and Conduit.
   2. Triangle Wire and Cable, Inc.
   3. Wheatland Tube Company.
   4. Or approved substitution.

B. PVC Coated Steel Conduit:
   1. Occidental Coating Company (O-Cal Blue).
   2. Robroy Industries, Inc.
      a. Rob-Roy Red.
      b. Plasti-Bond Red.
      c. Perma-Cote Green.
      d. Or approved substitution.

C. PVC Rigid Conduit:
   1. Cantex.
   2. Carlon Industries, Inc.
   3. Or approved substitution.

D. Conduit Fittings and Bodies:
   1. Appleton Electric.
   2. Crouse-Hinds.
   5. Or approved substitution.

2.2 MATERIALS

A. Design Conditions. Use electrical conduit, fittings, and bodies designed for service in areas as specified in Drawings and this section to form a continuous support system for power, control, and instrument cables or any combination thereof.

B. Conduit and Fittings:
   1. Rigid Steel Conduit and Fittings:
      a. Rigid steel conduit and rigid steel conduit bends, nipples, and bodies shall be hot-dipped galvanized and shall comply with the latest codes and specifications listed under 1.3, References.
      b. Mild steel tubing shall be used for conduit, nipples, and couplings, and shall be free of defects on both the inner and outer surfaces.
      c. Fittings and bodies and covers for rigid steel conduit shall be steel or cast-iron and shall comply with all codes and specifications listed under section 1.3, References.
   2. PVC-Coated Rigid Steel Conduit and Fittings:
      a. PVC-coated conduit, fittings, bodies, and covers shall conform to NEMA RN 1 (Type A). Rigid steel galvanized conduit and fittings shall conform to FSWW-C-58 D and ANSI C 80.1. PVC-coated rigid metal conduit must be UL listed with PVC as the primary corrosion protection. Conduit bodies shall conform to UL 514 B and FSW-C-58 C. PVC-coated fittings
for general service locations must be UL listed with the PVC as the primary corrosion protection. Provide sufficient coating for touch-up after installation.

b. PVC-coated couplings shall be of the ribbed type.
c. Condulet covers shall have encapsulated stainless steel thumbscrews.
d. Conduits and covers shall be of malleable iron or ferroalloy material before coating.
e. Urethane coating shall be a minimum of 2-mil thickness on the interior of the conduit and the interior of fittings, condulets, covers, and bodies.

3. PVC Conduit and Fittings: Use PVC conduit, bends, and fittings, which comply with NEMA TC 2, W-C-A, and NBC Article 347-17 for above ground and underground installation. Conduit shall be Schedule 40, unless shown otherwise.

PART 3 EXECUTION

3.1 GENERAL

A. Ensure that the conduit system to be installed is sized properly for the cable and wire requirements.

B. Verify the actual physical conduit route from the conduit plan drawings and prepare the conduit support system.

C. Verify the equipment locations to which the conduit will be connected and determine detail requirements for connections.

3.2 INSTALLATION

A. General Requirements: Except as otherwise indicated, install conduits as follows:

1. Install conduit as near as possible to the routing indicated.
2. Shift locations as required to avoid interference with structures, piping, valves, ducts and other mechanical and plumbing equipment and piping being installed.
3. Route all conduit, concealed or exposed, parallel or perpendicular to walls, ceilings, and building lines. Do not run conduit diagonally unless otherwise indicated.
4. Conduit shall be run concealed unless otherwise indicated.
5. Coordinate conduit group locations with other trades for common use of hangers and supports where practical.
6. Do not install conduits, couplings, elbows or fittings with blisters or other visible defects or damages in the external finishes. Do not install PVC coated conduit with visible defects or damage to the jacket.
7. Do not exceed the following number of bends between boxes or manholes handholes as stipulated in NEC 346-11 except that on runs exceeding 100-feet, pulling tensions shall be calculated for the actual cable pulled. The maximum tension shall not exceed the manufacturer's recommendations.
8. Empty conduits shall be capped or plugged immediately after installation unless wire or cable is to be immediately installed.
9. Clean conduits before pulling wire or cable.
10. Brace or anchor conduit sufficient to resist displacement when wires are being pulled.
11. Place drainage fittings or weep holes at unavoidable low points in conduit runs where moisture can collect.

12. Install expansion fittings in runs crossing expansion points where conduits which are attached to independent structures.

13. Bends shall be carefully made with suitable bending tool, so that no kinking or reduction of internal diameter results. The inner radius of any field bend shall be not less than six times the normal conduit diameter. Use large radius gradual sweeps where possible. Hickey bends will not be acceptable on 1" and larger conduits. When bending PVC coated conduit use special equipment as recommended by the conduit manufacturer to avoid coating damage. Under certain conditions, plans may call for conduit field bends up to 180 degrees, in which case NEC 344.24, Table 2, Chapter 9 shall be complied with to ensure internal diameter of conduit is not reduced due to limitations of field bending equipment. Special bending equipment may be required for this purpose at no additional cost to Port of Houston Authority.

14. Rigid conduit shall be joined and terminated by threaded couplings and connectors only. Field cut threads shall be clean and sharp, full depth or the die, standard 3/4-inch per foot taper. Field cut threads on steel conduit in interior locations shall be protected by proper application of coating and by the conduit manufacturer when applicable for PVC coated conduit.

15. Field cuts of conduit shall be square to the axis of the conduit. Carefully ream all conduit ends. Make up joints tightly butted. All joined conduit shall be made up wrench-tight. Use wrenches that will not damage galvanizing or PVC coating in accordance with the conduit manufacturer's recommendations. Where standard couplings cannot be used, make up joints with split couplings or 3-piece "Erickson" couplings. Running threads on conduit couplings are not acceptable.

16. Fasten all conduit and cable rigidly into all outlet boxes, panels, cable boxes, pullboxes, junction boxes, safety switches, and all other devices in the conduit system. The conduit system shall be electrically continuous and securely grounded to the building system ground.

17. At connections to all switchboards, panels, wireways and troughs, motor starter panels, outlet boxes, pullboxes, junction boxes, signal boxes, and similar items of electrical equipment, use Myers Hubs or equal. Locknuts are not acceptable.

18. Conduits installed in pipe shaft shall be properly supported to carry the total weight of the raceway system complete with cable. In addition, at least one insulated brace per 10-foot section shall be provided to assure stability of the raceway system.

19. Where indicated on plans or in other specification sections, install PVC-coated conduits in all outdoor locations plus inside valve vaults and wet wells; plus in all other corrosive and wet environment. Install PVC-coated conduit in strict accordance with manufacturer's instructions. Use installers certified by the manufacturer.

20. Install rigid galvanized steel (RGS) conduits in dry inside locations and outdoor locations where indicated on drawings.

21. Install PVC conduits in duct banks or encased in concrete slabs. For stub-ups, use PVC coated rigid steel elbows. Where conduits exit concrete duct bank or slab change to PVC coated RGS a minimum of 18 inches inside the concrete.

22. Use minimum 4 feet radius bends in duct banks and in all conduits for MV cable or 600-volt cable installations great than I/O size.

23. Run exposed conduit parallel or perpendicular to walls, ceilings, or main structural members. Group multiple conduits together where possible. Conduit shall not interfere with the use of passageways, doorways, overhead cranes, monorails, equipment removal areas, or working areas.
a. In no case shall conduit routing present a safety hazard or interfere with normal plant operating and maintenance procedures. A minimum overhead clearance of 8 feet shall be maintained in passageways.

24. Installation and support of conduit shall be from steel or concrete structures in accordance with the standard detail drawings. Furnish necessary conduit straps, clamps, fittings and support for the conduit in accordance with the standard details.

25. Identify conduit at termination points such as switchgear, breaker panels, MCC's, light fixtures, control panels, receptacles, junction boxes, manholes, and vaults.

26. Install conduit runs so that they are mechanically secure, mechanically protected from physical harm, electrically continuous, and neat in appearance. The interiors of conduit shall provide clean, smooth raceways through which conductors may be drawn without damage to the insulation. Make threaded connections wrench tight.

27. Cut conduit square with a power saw or a rotary type conduit cutter designed to leave a flat face. Do not use plumbing pipe cutters for cutting conduit. Ream the cut ends of conduit with a reamer, designed for the purpose to eliminate rough edges and burrs. Threads shall be cut (minimum five) with standard conduit dies providing 3/4-inch taper per foot, allowing the proper length so that joints and terminals may be made up tight and the ends of the conduit not deformed. Keep dies sharp and use a good quality threading oil continuously during the threading operation. Remove metal cuttings and oil from the conduit ends after the threads are cut and paint threads before connections are made. Use non-corrosive Carbozinc No. 11 as manufactured by the Carboline Company, coal tar enamel or zinc rich epoxy primer on the threads of steel conduit before connections are made.

28. Use strap wrenches only to tighten joints in plastic coated rigid steel conduit. Replace all conduit and fittings with damage to the plastic coating, such as cuts, nicks and threader chuck jaw marks. Use a solvent, or the same patching material to seal around the edges of conduit fitting covers. Do not field bend plastic coated rigid steel conduit.

29. Make up changes in direction of conduit using elbows or fittings. Do not use pull boxes to make direction changes unless specifically designated otherwise.

30. Field fabricated bends shall be free of indentations or elliptical sections. The radius of the bend shall not be less than 6 times the smallest diameter of the raceway but shall not be less than 4 feet.

31. Protect all conduit terminations from mechanical injury. Prevent the entry of moisture and foreign matter into the conduit system by properly capping terminations.

32. Avoid trapped runs of conduit, if possible. When they are necessary, provide drainage using a "tee" conduit equipped with a drain. Conduit is likely to pass through areas with a temperature differential of 20 degrees F or more. Seal penetrations with a proper seal fitting at the wall or barrier between such areas. For conduit passing through walls separating pressurized areas from non-pressurized areas, install sealing fittings at the wall on the non-pressurized side.

33. Fit all conduit crossing building or structure expansion joints with approved expansion fittings, except that fittings will not be required when conduit crossing an expansion joint is supported on trapeze hangers in such a way that at no time will the conduit be under stress due to expansion. Install bonding jumpers around expansion joint fittings.

34. Where conduit terminates in sheet metal enclosures and where no threaded hubs are provided, fit the conduit with double locknuts and bushings. Sheet metal enclosures located outside or in any other wet, damp, or corrosive areas shall be furnished with threaded hubs. Restrict side penetrations to the lower one third of the enclosure.
35. Provide flexible metallic conduit where necessary to allow for movement or to localize sound or vibration, at motors and any other rotating equipment unless shown otherwise on Drawings.

36. Seal all openings or holes where conduits pass through walls or floors. When passing through a firewall or floor, use a fire-rated seal per the typical detail included in the Drawings. Certain walls, as indicated on the drawings, require environmental (airtight) seals; seal as indicated on the Drawings.

37. Unless otherwise indicated on Drawings, install expansion fittings every 300 feet within a straight conduit run and where conduit crosses building expansion joints, using bonding straps to ensure ground continuity.

38. Parallel runs of conduit may be supported by structural steel racks. When two or more racks are arranged one above the other, provide vertical separation of not less than 12 inches between racks, unless otherwise indicated on Drawings. Space conduits on the racks at least enough to provide 1/4-inch clearance between hubs on adjacent conduits at terminations and to allow room for fittings.

39. Fill conduit racks no more than 75 percent of their capacity, providing usable space for future conduit. To ensure this, conduits leaving the rack horizontally shall be offset up or down so that future conduits may be installed in the space remaining. Construct conduit racks to permit access for wire or cable pulling at all pull points, even when future conduits are added to fill the racks.

40. Where conduit racks are supported on rods from beam clamps or by some other non-rigid suspension system, install rigid supports at no more than 50-foot intervals to give lateral stability to the rack.

41. Conduit racks or hangers must in no way interfere with machinery (or its operation), piping, structural members, equipment, or access to anticipated future equipment. Refer to architectural, structural, equipment layout and piping drawings to ensure that this requirement is met. Label high voltage conduit with the circuit phase-to-phase voltage by means of a firmly attached tag or label of approved design at each conduit termination, on each side of walls or barriers pierced and at intervals not exceeding 200 feet along the entire length of the conduit.

42. Support conduit sizes 2 inches and larger at spacings not exceeding 10 feet and conduit sizes 1-1/2 inches and smaller at spacings not exceeding 8 feet.

43. The means of fastening conduit to supports shall be: by one hole malleable iron conduit straps secured by wood screws to wood and by bolts with expansion anchors to concrete or masonry; by "Korn" clamps or U-bolts to other surfaces. Use "clamp backs" when strapping conduits to walls, column faces, or other such surfaces.

44. Support conduit runs with conduit clamps, hangers, straps, and metal framing channel attached to structural steel members. Conduits of 1-1/2 inch size or less may be supported by one-hole conduit straps on concrete, tile or steel work, but for larger size conduit, 2-hole straps shall be used. Use clamps of galvanized malleable iron for rigid galvanized conduit and PVC-coated or stainless steel for PVC-coated conduit. Metal framing channel straps used for PVC-coated conduit shall be type 316 stainless steel.

45. Install conduits supported form building walls with at least 1/4-inch clearance from the wall to prevent the accumulation of dirt and moisture behind conduit.

46. Install an embossed stainless steel tag at each end of conduit run. The embossed tag I.D. shall match the conduit I.D. on the new conduit and cable schedule.

B. Exposed Locations: Except as otherwise indicated, install conduits in exposed locations where indicated as follows:

1. Install horizontal runs as high above floor as possible.
2. Route to clear all doors, windows, access wells, and openings.
3. Group parallel runs in neatly aligned banks whenever possible with minimum of
1-inch clearance between conduits.
4. Maintain 6-inch clearance between conduits and coverings on all hot lines: steam, hot water, etc.
5. Do not exceed a distance of 8 feet between supports on horizontal or vertical runs.
6. On exposed conduit runs, where changes in direction cannot be made with standard radius bends, such as at columns or beams, provide screwed conduit fittings of a type suitable for the installation.

C. Concealed Locations: Except as otherwise indicated, install concealed conduits in finished and other areas, as indicated, and as follows.
1. Conduit for lighting, convenience outlets, and other circuits shall be run in concrete slabs and/or paving.
2. Do not install conduits in concrete walls or slabs where conduit diameter exceeds one-third of concrete thickness.
3. Install parallel runs in concrete walls or slabs with a minimum spacing of three conduit diameters between conduits.
4. Tie conduits securely in place to prevent movement when concrete is poured. Install in floor slabs in as straight a run as possible.
5. Use long radius elbows except on risers where curved portion of elbow would extend above the finished floor or foundation.
6. Conduits in masonry walls shall be run vertically, except where the on-center distance between adjacent outlets is 18 inches or less. For such closely spaced outlets, horizontal runs will be permitted.

D. Buried Locations: Except as otherwise indicated, install PVC conduit in buried locations as follows.
1. Place conduit along routing indicated and in coordination with underground material being placed by other contracts.
2. Bury conduits a minimum of 48 inches below finish grade unless indicated otherwise on drawings.
3. Slope conduit away from conduit risers. Conduits to drain toward concrete junction boxes or other enclosures.
4. Maintain 6-inch separation from underground piping.
5. Use long radius bends at all risers unless indicated otherwise. After trench bottom has been finished to grade, lay conduit, then carefully backfill trench in layers of 4 inches to 8 inches of dry material, and tamp each layer with a proper compaction tool.
6. Cap ends of all conduit risers before backfilling.
7. After installation of underground conductors, the inside of each conduit shall be sealed to prevent water or gases from entering the building. Sealing shall be accomplished with an approved sealing compound at the point of entrance into the building.
8. Cable sealing compound shall be non-hardening "Duxseal" adhesive as manufactured by Johns-Manville, Barnard Duct Seal, or approved substitution.
9. Install PVC conduits in duct banks or encased in concrete slabs. For stub-ups, use PVC coated rigid steel elbows.

E. Empty Conduit System:
1. Provide empty raceway from each outlet to the termination point as noted on drawings.
2. Where specific termination location is not indicated, stub raceway with a bushing into nearest accessible enclosure as directed by The Port Construction Representative. Provide with fish wire.

3. Raceway shall consist of rigid galvanized steel, 1-inch minimum size, unless noted otherwise.

4. Provide junction and pullboxes at all required locations indicated on drawings and where more than 270 degrees of bends occurs in a run of raceway.

5. Junction and pull boxes shall be sized to meet the cabling requirements of the system being installed.

6. Covers shall be removable and secured with screws.

7. Outlets shall be standard receptacle type outlet boxes as specified in other sections.

8. Where multi-outlet application is required, provide multi-gang outlet as required.

9. Unless noted otherwise, provide a device plate with a 3/4-inch bushed opening with a finish to match receptacles in the area.

10. Provide a nylon fish wire for all raceway exceeding 10 feet in length.

F. Fiber Optic Conduits: Use wide sweep bends suitable for conduits designated for fiber optic cable installation.

G. Innerduct: See Section 27 05 28.35 - Innerduct Conduit for installation of innerduct inside conduits designated for fiber optic, data cables, coaxial cables or communications cables where indicated in specification sections or shown on plans.

H. Conduit Stub-Ups Into Equipment Sections: Where conduits are stubbed up into equipment sections described in Section 26 20 10.00 - Unitized Transformer Station, and Section 26 18 40.00 - Vacuum Loop Switch-Circuit Breaker Assembly, Contractor shall refer to Manufacturer's most current certified conduit entry drawing details for that equipment and shall stub-up conduits accurately positioned according to the Manufacturer's details. All stub-ups are to be PVC coated rigid galvanized steel.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for device, pull, and junction boxes.

1.2 REFERENCES

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):
   1. FB1 - Fittings and Support for Conduits and Cable Assemblies.
   2. 250 - Enclosures for Electrical Equipment (1000 volts maximum).

   NFPA70 - National Electrical Code (NEC) - Article 370 - Outlet Device, Pull and Junction Boxes, Conduit Bodies and Fittings.

C. Underwriters Laboratories (UL):
   1. UL 50 - Safety Cabinets and Boxes.
   2. UL 508 - Safety Industrial Control Equipment.
   3. UL 514B - Safety Fittings for Conduit and Outlet Boxes.

1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following details are required.

1. Manufacturer's cut sheets, catalog data.
2. Instruction for handling and storage.
3. Installation instructions.
4. Dimensions and weights.
1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall repair all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY, STORAGE AND HANDLING

A. Pack and crate boxes to permit ease of handling and to provide protection from damage during shipping, handling, and storage.

1.6 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Sheet Metal Boxes:
   1. Hoffman Industrial Products.
   3. Hennessy.
   4. Tanco.
   5. Tejas.
   6. Circle A.W.
   7. Or approved substitution.

B. Cast Device Boxes:
   1. Appleton Electric Company.
   2. Crouse-Hinds.
   4. Or approved substitution.

2.2 MATERIALS AND EQUIPMENT

A. Sheet Metal Boxes:
   1. Provide UL-approved junction boxes and pull boxes manufactured from stainless steel sheet metal and meeting requirements of NEMA 4X for corrosive and wet area, NEMA 250 and NEC Article 370.
   2. Provide boxes with a stainless steel continuous hinge, closure hasps, and all-stainless steel hardware.
   3. Furnish the door with neoprene gasket and provision for padlock.
B. Device Boxes:
   1. Provide UL-approved boxes designed and manufactured to house electrical devices like receptacles and switches, and in conformance with NEMA FB1 and NEC Article 370.
   2. Supply boxes that are hot-dip galvanized on cast iron suitable for corrosive and wet atmosphere.

C. Hardware:
   1. Mounting Hardware: Stainless steel
   2. Conduit Connectors: Watertight as manufactured by Myers Hubs, or approved substitution.

PART 3 EXECUTION

3.1 INSTALLATION

A. Boxes described in this specification shall be used both in dry and wet, corrosive areas, both inside and outside locations.

B. Install boxes in accordance with NEC Article 370 in locations indicated on the Drawings.

C. Install junction and pull boxes in readily accessible places to facilitate wire pulls, maintenance, and repair.

D. Plug unused conduit openings.

E. Make conduit connections to sheet metal boxes with watertight conduit connectors.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 05 36.00 Add – NON-METALLIC CABLE TRAY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests, and services to install complete cable tray systems as shown on the drawings.

B. Cable tray systems are defined to include, but are not limited to straight sections of ladder type, vented bottom type, solid bottom type, cable trays, bends, tees, elbows, drop-outs, supports, and accessories.

1.2 REFERENCES

A. ANSI/NFPA 70 – National Electrical Code

B. NEMA FG 1-1998 – Non-Metallic Cable Tray Systems

C. NEMA VE 2-2000 – Cable Tray Installation Guidelines

D. Port of Houston Authority Electrical Code

1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following are required:

1. Manufacturer's cut sheets, catalog data, and sizes.
2. Installation, connection and supporting methods.
3. Instruction for handling and storage.

C. Submit drawings of cable tray and accessories including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies, and fittings, showing accurately scaled components.
D. **Product Data:** Submit Manufacture’s data on cable tray including, but not limited to, types, materials, finishes, rung spacings, inside depths and fitting radii. For side rails and rungs, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).

### 1.4 QUALITY ASSURANCE

A. **Protection:** All work, equipment, and materials shall be protected at all times. The Contractor shall repair all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage.

All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. **Manufacturers:** Firms regularly engaged in manufacture of cable trays and fittings of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

C. **NEMA Compliance:** Comply with NEMA Standards Publication Number FG-1, “Non-Metallic Cable Tray Systems.”

D. **NEC Compliance:** Comply with NEC, as applicable to construction and installation of cable tray and cable channel systems (Article 318, NEC.)

### 1.5 DELIVERY STORAGE AND HANDLING

A. Deliver cable tray systems and components carefully to avoid breakage, denting and scoring finishes. Do not install damaged equipment.

B. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials should be unpacked and dried before storage.

### 1.6 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

## PART 2 PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with these specifications, cable tray systems shall be as manufactured by Endro Systems or approved equal.

### 2.2 CABLE TRAY SECTIONS AND COMPONENTS

A. General: Except as otherwise indicated, provide non-metallic cable trays, of types, classes, and sizes indicated with splice plates, bolts, nuts, and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with
applicable standards; and with the following additional construction features. Cable tray shall be installed according to the latest revision of NEMA VE 2.

B. Materials and Finish: Straight section structural elements; side rails, rungs and splice plates shall be pultruded from glass fiber reinforced polyester or vinyl ester resin.

C. Pultruded shapes shall be constructed with a surface veil to insure a resin-rich surface and ultraviolet resistance.

D. Pultruded shapes shall meet ASTM E-84, Class 1 flame rating and self-extinguishing requirements of ASTM D-635.

E. Unless specifically shown otherwise on plans provide cable tray for cables and conductors of all voltage ranges in manholes and pull boxes.

2.3 TYPE OF TRAY SYSTEM

A. Ladder cable trays shall consist of two (2) longitudinal members (side rails) with transverse members (rungs) mechanically fastened and adhesively bonded to the side rails. Rungs shall be spaced 9 inches on center. Rung spacing in radiused fittings shall be industry standard 9 inches and measured at the center of the tray’s width. Each rung must be capable of supporting a 200 pound concentrated load at the center of the cable tray with a safety factor of 1.5.

B. Ventilated bottom cable trays shall consist of two (2) longitudinal members (side rails) with a solid sheet over rungs spaced on 4-inch centers.

C. Solid bottom cable trays shall consist of two (2) longitudinal members (side rails with a solid sheet over rungs spaced on 12-inch centers.

D. Cable tray loading depth shall be 5 inches per NEMA FG 1.

E. Straight section shall be supplied in standard 10-foot lengths, unless factory cut to exact lengths required for specific applications.

F. Cable tray inside widths shall be 6, 9, 12, 18, 24, 30, or 36 inches as shown on drawings. Outside width shall not exceed inside by more than a total of 2 inches.

G. Straight and expansion splice plates will be of “L” shaped lay-in design with an eight-bolt pattern in 5-inch fill systems and four-bolt pattern in 3 inch and 2 inch fill systems. Splice plates shall be furnished with straight sections and fittings. Bend sections may be used for 90 degree turns in tray direction or in corner of manholes, unless specifically prohibited on plans. Radius of bends shall not be less than minimum allowed radius of cable bends.

H. All fittings must have a minimum radius of 12, 24, or 36 as shown on drawings and, as limited by cable bending radius.

I. Molded fittings shall be formed with a minimum 3-inch tangent following the radius.

J. Systems with 3-inch loading depth shall have 90 degree and 45 degree molded fittings in 12 inch or 24 inch radius.
K. Systems with 5-inch loading depth shall have 90 degree and 45 degree molded fittings in 24 inch or 36 inch radius.

L. All other fittings shall be of mitered construction.

M. Dimension tolerances will be per NEMA FG 1.

2.4 LOADING CAPACITIES

A. Cable trays shall meet NEMA class designation 20C.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install cable trays as indicated: Installation shall be in accordance with Equipment Manufacturer’s instructions, and with recognized industry practices to ensure that cable tray equipment comply with requirements of NEC and applicable portions of NFPA 70B. Reference NEMA VE 2 for general cable tray installation guidelines.

B. Coordinate cable tray with other electrical work as necessary to properly integrate installation of cable tray work with other work.

C. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cable.

D. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE 2 guidelines, or in accordance with Manufacturer’s instructions.

3.2 TESTING

A. Upon request, Manufacturer shall provide test reports witnessed by an independent testing laboratory of the “worst case” loading conditions outlined in this specification and performed in accordance with the latest revision of NEMA FG 1.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for Underground electrical and communication duct banks.

1.2 REFERENCES

A. National Fire Protection Association (NFPA): No 70 – National Electrical Code (NEC) Appendix B.


C. American Concrete Institute (ACI): 318-02 – Building Code Requirements for Structural Concrete.

D. American Society for Testing and Materials (ASTM):


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following are required.

1. Catalog cut sheets of the ducts and spacers.
2. Dimensions and sizes.
3. Instruction for installation.
4. Instructions for storage and handling.

C. Should the Contractor determine that a variation from the as-design underground ductbank system be required based on field and/or other conditions, the Contractor is to
submit all underground ductbank profile variations in AutoCAD format for review and approval of The Port Construction Representative prior to actual installations.

1.4 QUALITY ASSURANCE
A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY, STORAGE AND HANDLING
A. Have ducts spacers and associated hardware packed and crated to avoid damage during shipment and handling.
B. Clearly mark packages or crates stating that the material is for electrical duct banks only.

1.6 MEASUREMENT AND PAYMENT
A. Payment for ‘Underground Conduit Ductbank System’ shall be on a Lump Sum basis for material, labor, and all other incidentals required, complete in place and accepted.

PART 2 PRODUCTS
2.1 MATERIALS AND EQUIPMENT
A. Conduit: Refer to Section 26 05 33.01 – “Conduit, Fittings, and Bodies.”
   1. Limit conduit bends to 4 feet radius minimum in duct bank installations.
B. Spacers: Secure conduit with non-magnetic, universal, interlocking-type spacers for both horizontal and vertical duct arrangements.
C. Concrete: Use steel reinforced, 3000 psi, red concrete as duct encasement. See detail on drawing. Refer to Section 03 20 00.00 – “Structural Concrete Reinforcement”; Section 03 21 00.00 – “Reinforcing Steel for Pavement and Utilities”; Section 03 30 00.00 – “Cast-in-place Concrete.”
D. Trenching: Refer to specifications.

PART 3 EXECUTION
3.1 GENERAL
A. Verify from Drawings and field survey that the as-design ductbank system does not interfere with any existing or new underground facilities or underground structures.
B. Verify that materials are on site are in proper condition and that sufficient quantity is on hand for the work.
C. Verify that trenches are in the correct places and prepared with sufficient depth and width to accommodate the duct banks, reinforcing rod, and concrete. Cut the trenches neatly and uniformly. After excavation of the trench, stakes shall be driven in the bottom of the trench at 4-foot intervals to establish the grade and route of the duct bank. Pitch the trenches uniformly towards manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts towards buildings. The walls of the trench may be used to form the side walls of the duct bank provided that the soil is self-supporting and that concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting. After the concrete encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, with appropriate warning tape attached.

D. The Port Construction Representative shall approve the layout after inspection of the duct banks before reinforcing rod is installed.

E. Before pouring concrete, verify that the ducts are free of debris and properly installed in the support and spacer systems and that the ducts are properly fitted together and firmly held in place by the hold down hardware.

F. Pour concrete within limits of duct bank and shall not overflow. Remove all concrete spoils from site. Do not bury unused concrete on site.

G. Minimum conduit bending radius for underground ductbanks shall be 4 feet.

3.2 INSTALLATION

A. Use the size and types of conduit as indicated on the Drawings for the various duct banks required for the project.

B. Make duct bank installations and penetrations through foundation walls watertight.

C. Assemble duct banks using non-magnetic saddles, spacers, and separators. Position separators to provide minimum concrete separation between the outer surfaces of the conduits as shown on plans and details. Arrange saddle/spacers to allow conduit support at 4 feet intervals.

D. Provide a 3-inch minimum concrete covering on both sides, top and bottom of concrete envelopes around conduits. Add red dye at the rate of 10 pounds per cubic yard to concrete used for envelopes outside the proposed Container Yard paving limits to allow for easy identification during subsequent excavation.

E. Firmly fix ducts in place during pouring of concrete. Carefully spade and vibrate the concrete to ensure filling of spaces between ducts.

F. Make a transition from non-metallic to metallic rigid conduit where duct banks enter structures or turn upward for continuation above grade. Provide a minimum of 18 inches of metallic rigid conduit within concrete duct or slate.

G. Make bends of 30 degrees or more using rigid galvanized steel.

H. Reinforce duct banks throughout, where indicated on the Drawings.

1. Unless otherwise noted on the Drawings, reinforce with No. 4 longitudinal steel bars placed at each corner and along each face at a maximum parallel spacing.
of 12 inches on centers, and No. 5 tie-bars transversely placed at 18-inch maximum longitudinal intervals.

2. Maintain a minimum clearance of 3 inches from bars to the edge of the concrete encasement.

I. Where ducts enter structures such as handholes, manholes, pullboxes, or buildings, terminate the ducts in suitable end bells, insulated L-bushings, Meyers hubs or couplings on steel conduits. Tag conduit entering pull boxes with stamped, stainless steel tags. Identify as designated in cable and conduit schedule.

J. Do not backfill with material containing large rock, paving materials, cinders, large or sharply angular substances, corrosive material, or other materials, which can damage or contribute to corrosion of ducts or prevent adequate compaction of fill.

K. Install a bare stranded copper conductor size 350 MCM above in each duct bank envelope or, as otherwise shown on drawing details. Make ground electrically continuous throughout the entire duct bank system. Splices shall be by means of exothermically welded connections. Connect ground to switchgear and equipment ground buses, ground rods (in manholes) and to steel conduit extensions of the underground duct system.

L. After completion of the duct bank and prior to pulling cable, pull a mandrel, sized for the duct size and with a cross section approximately one-fourth inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to remove any particles of earth, sand, or gravel that may have been left in the duct. Repull the rag or sponge swab until the swab emerges clean.

M. Use hemp rope or approved substitute to pull conductors into PVC conduit. Do not use nylon or wire cable for this purpose.

N. Install a warning ribbon approximately 12 inches below finished grade over underground duct banks. Refer to Section 26 05 53 - Electrical Identification.

O. For manholes and pull boxes below grade, install steel or non-metallic racks to support cables properly around the perimeter and keep them dry. Refer to Section 33 71 19.00 – “Electrical Manhole and Handhole”.

P. For manholes and pull boxes below grade, construct a french drain, or other drainage as detailed on the Drawings.

Q. Plug all unused conduit openings with suitable conduit plugs.

R. Refer to cable pulling methods and requirements described in Section 26 05 19 “Building Wire and Cable” and Section 26 05 13.16 – “Medium Voltage Power Cable” before starting cable pulls.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 05 53.00 Add – ELECTRICAL IDENTIFICATION

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specification for electrical identification including: Nameplates and labels, wire and cable markers, conduit markers, cable tray markers, underground warning tape, and warning labels.

1.2  REFERENCES

A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA):
   1. No. 70 - National Electrical Code (NEC):
      a. Article 110 - Requirements for Electrical Installation.
      b. Article 430 - Transformers and Transformer Vaults.
   2. No. 70E – National Electrical Code (NEC) – Standard for Safety in the Workplace
C. Section 26 60 01 – “Arcproofing”
D. Section 26 60 02 – “Protective Device Coordination,” Paragraph 2.4 entitled “Arc Flash Warning Labels.”

1.3  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following are required:

   1. Manufacturer's cut sheets and catalog data.
   2. Description of materials used.
   3. Label or nameplate dimensions.
   4. Engraving or imprint legends.
   5. Instruction for handling and storage.
   6. Installation instructions.
   7. Samples if available.
1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY, STORAGE AND HANDLING

A. Pack materials to permit ease of handling and to provide protection from damage during shipping, handling, and storage.

1.6 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Almetek Industries Incorporated.
B. Brady U.S.A. Incorporated.
C. Ideal Electric Company.
D. Raychem Corporation.
E. 3M Electrical Products Division.
F. Thomas & Betts.
G. Tyton Corporation.
H. Or approved substitution.

2.2 MATERIALS AND EQUIPMENT

A. Nameplates and Labels:

1. Provide an identification tag for each item of electrical equipment showing its item number and service or application. Use the description shown on the electrical Drawings.

2. For nameplates, use 3-ply phenolic material engraved to show black lettering on a white background. Size the nameplates approximately 1 inch wide and 3 inches long for three (3) lines of 3/16 inch - 16 letters with a 0.8 condensed factor. Nameplates shall be attached with stainless steel screws. Adhesive type attachment is not allowed.

3. Generally, provide large pieces of equipment with engraved nameplates; provide additional nameplates at pushbuttons and other local devices; as detailed. Provide identification for all other electrical equipment, device, or enclosure not
furnished with readily noticeable tag, nameplates, or other means of identification.

4. Install nameplates on the front cover of transformers stating the transformer service location number or identification number, the panelboard or device served, and main breaker feeding the transformer (MCC No. and compartment), and the drawing number on which the transformer schematic is shown.

5. Furnish equipment, such as motor starters, safety switches, receptacles and circuit breakers, with 1" x 3" plastic nameplates stating description of item served, and circuit and panel numbers e.g. LP-2A-CKT#22.

6. Provide nameplates for motors giving the driven equipment description, the service location number, and the MCC number with compartment number when applicable. Nameplates will normally be mounted adjacent to the motor at the motor pushbutton when one is furnished.

7. Install nameplates on the outside and inside of doors to circuit breaker panelboards (i.e., lighting, instrument, or receptacle panels). State the panelboard name, the drawing number on which the panelboard schedule shows, and the main breaker feeding the panel (MCC No. and compartment).

8. Install typed panelboard directories and insert them inside the panelboard doors. Directories shall indicate load served by each circuit of panelboard. Directories shall also indicate source of service to panelboard. Directories shall be typed and sealed against moisture behind a transparent protective document sleeve.

9. Place a large nameplate approximately 3"x5" on control panels, relay panels, junction boxes or enclosures with electrical devices mounted inside or on the outside of the enclosure indicating the purpose of the cabinet.

B. Wire and Cable Markers:

1. Use pre-printed tubular heat-shrink type wire and cable markers.
2. Select markers manufactured so that the heat-shrink process makes the imprint permanent and solvent-resistant.
3. Use markers that are self-extinguishing, conforming to U.L. Standard No. 224 for print performance, heat shock, and flammability.
4. Provide marker material that is flexible, radiation cross-linked polyolefin with 3 to 1 shrink ratio, rated 600 volts, and white in color.

C. Conduit Markers:

1. Provide conduit markers made of stainless steel tags approximately 2 inches x 1 inch x 19 gage.
2. Stamp the caption on the tag and have it black filled.
3. Punch tags for tie fasteners. Fasten tags to the conduits with stainless steel braided wire.

D. Underground Warning Tape:

1. Provide warning tape made of 4-mil thick polyolefin film, 3 inches wide, suitable for direct burial, and resistant to alkalis, acids, and other common soil substances.
2. Use red tape with black legend printed in permanent ink.

E. Warning Labels:

1. Place OSHA safety labels on enclosures and boxes 100 cubic inches or more containing electrical equipment or terminations.
2. Provide OSHA color codes for the labels. Use labels made from 4-mil vinyl with pressure sensitive adhesive backing.
3. The warning label caption is DANGER - 480 VOLTS or as indicated on the Drawings.
4. Size labels either 5 inches x 3-1/2 inches or 10 inches x 7 inches, as indicated on the Drawings.
5. Place arc flash warning labels as provided by Port of Houston Authority at each work location required. Refer to Section 26 60 02 – “Protective Device Coordination,” Paragraph 2.4 entitled “Arc Flash Warning Labels” for additional requirements.

F. Manholes: Provide manhole numbers on 316 stainless steel, 3” x 5” tags attached to manhole covers with stainless steel screws.

G. Apply warning, caution, and instruction signs and stencils as follows:

1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
2. Install warning signs on the following equipment as a minimum requirement.
   a. MCC Main Breaker
   b. Main Service Breaker
   c. Transfer Switch
   d. Where exposed bus bars inside.
   e. Automatic Power Factor Correction Units
   f. VFD’s and Solidstate Starters
   g. Other locations described in No. 1 above.
3. Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8 in. (9 mm) high lettering for emergency instructions on power transfer, load shedding, and or emergency operations.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces where adhesive labels will be applied.
B. Drill holes for nameplates to be fastened with stainless screws.
C. Prepare the cable ends for termination and conductor markings.
D. Identify conduits at terminating points and select tags accordingly.

3.2 INSTALLATION

A. Install nameplates and labels in accordance with the manufacturer's instructions and the Drawings.
B. Apply wire and cable markers in accordance with manufacturer's instructions using a heat gun with properly sized nozzle for the application of heat shrink markers. Tag the wires at both ends with the same notation.

CSP Date: April 1, 2014  26 05 53.00 Add  ELECTRICAL IDENTIFICATION
Page - 4
C. Tag conduits at junction boxes, pull boxes, manholes, and at other termination or end points. Tag conductors at all termination points, pull boxes, manholes, junction boxes, and all device connections.

D. Identify underground conduits, cables or duct banks using the underground warning tape. Identify the underground grounding grid, including the laterals; also use underground warning tape. Install one tape per trench at 12 inches below grade or as indicated on the Drawings. For wide trenches or duct banks, install one warning tape per 24 inch width.

E. Apply the 5 inches by 3-1/2 inches warning labels to disconnect switches, panelboards, terminal boxes, and similar devices in accordance with manufacturer’s instruction and the Drawings. Apply the 10 inches x 7 inches warning labels to larger control panel enclosures, motor control centers and to entrance doors to buildings containing electrical power and control equipment.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 08 00.01 Add – MEDIUM VOLTAGE SYSTEM COMMISSIONING TEST

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the tests required for commissioning the medium voltage equipment shown on the Contract Drawings. These tests are to be performed in addition to the specified tests outlined in other sections of these Specifications.

1.2 REFERENCES:

A. The following is a listing of the publications referenced in this Section:

   b. ASTM D923 Method for Sampling Electrical Insulating Liquids
   c. ASTM D924 Test Method for AC Loss Characteristics and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.

1.3 QUALITY ASSURANCE

A. The Contractor shall secure the services of qualified personnel to perform inspection and testing. The required qualifications include, but are not limited to a minimum of five years experience in testing of this type.

B. The Port Construction Representative reserves the right to interview the actual personnel who will be assigned to perform the tests. Only those personnel authorized by the Port Construction Representative may perform the testing.

1.4 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit the name of the proposed NETA Certified testing firm including the following information:

1. Company resume.
2. List of references.
3. List of testing work completed of similar magnitude within the specified period.
4. Number of permanent employees with their employment duration.
5. List of test equipment owned or leased with their valid calibration certificates.

C. Submit a list of the proposed personnel and their resumes designated to perform the testing requirements of this Section.

D. Submit a sample of test forms to be used for the testing for the Port Construction Representative’s approval. If not approved by the Port Construction Representative, the testing firm shall resubmit the forms, with the changes, for the Port Construction Representative’s approval.

E. Submit test procedures, with sketches to illustrate how the test equipment will be connected to the equipment to be tested, for the Port Construction Representative’s approval. If not approved by the Port Construction Representative, the testing firm shall resubmit the test procedures, with the changes, for the Port Construction Representative’s approval.

F. Once all of the above items A-E have been satisfied, the testing firm shall submit a schedule indicating when the tests shall be performed.

G. After the testing has been completed, submit a test report for each unit within 15 calendar days of the completed testing to the Port Construction Representative for review. All test results and values shall be recorded on the forms approved by the Port Construction Representative.

H. The test sheet shall have all technical characteristics of the unit and all identification data including feeder name, building, substation, location, nameplate information, test date, and name of tester. “As found” and “As left” relay settings shall be documented. All discrepancies encountered shall be itemized and clearly described on the test sheet. All tabulations of the test data shall be in the Microsoft Excel format and shall be supplied on a disk as well as two bound hard copies. A report for each substation shall be provided indicating number of units tested, number of units not available to be tested, discrepancies found and cross references for more information to the specific test sheet. A summary of all reports along with the testing firm’s recommendation shall be submitted.

1.5 MEASUREMENT AND PAYMENT

A. Payment for ‘Medium Voltage Commissioning Tests’ shall be on a Lump Sum basis for material, labor, and all other incidentals required, complete in place and accepted.

PART 2 PRODUCTS

2.1 TESTING FIRMS

A. Subject to compliance with the requirements of this Section, provide the services of a Testing Firm that can be available within 6-hours of notification, or an approved substitute.

B. Qualified Testing Firms:

1. Emerson Process Management
2. Eaton
PART 3 EXECUTION

3.1 GENERAL

A. In addition to the tests outlined in Section 3.2 hereunder, perform all tests recommended by the manufacturer in manufacturer's instructions, shop drawings, as described in various sections of these Specifications, and as outlined on the Contract Drawings.

B. All tests must be witnessed by the Port Construction Representative. A written notice, at least fourteen days prior to the tests shall be given to the Port Construction Representative.

C. Test values shall be considered acceptable as specified by the manufacturer and approved by the Port Construction Representative.

D. Certified test reports shall be provided for Port Construction Representative review and acceptance. All unacceptable conditions shall be corrected by Contractor before “Final Acceptance” of installation.

E. Provide all reports bound in a three (3) ring binder and assembled in a professionally format. Send a single preliminary report for Port Construction Representative’s review and comments then, send six (6) copies of the final bound report to Port Construction Representative.

3.2 ELECTRICAL TESTS

A. General

1. Prior to the energization of any medium voltage equipment, all tests outlined in 3.1 above, and those outlined below in accordance with NETA ATS, shall have been performed by the Contractor and approved by the Port Construction Representative.

2. No voltage other than Megger output shall be applied to control voltage transformers during the performance of any tests, so that no high voltage can be induced on the primary of these transformers or into the high voltage system.

3. Verify that arc flash identification labels are in place as required on all equipment.

B. Medium Voltage Switchgear:

1. Perform the following tests on all the Current Transformers including those located within the ground and test device. Readings are to be taken at each protective relay to confirm wiring connections.
   a. Ratio test at all the taps with full primary current injection
   b. Polarity test with inductive kick method
   c. Measure secondary winding resistance
   d. Megger secondary winding at 1000VDC
   e. Perform magnetization curve test to the saturation voltage. Plot the curve and verify with the Accuracy Class claimed by the manufacturer.

2. Perform the following tests on all the Voltage Transformers:
   a. Ratio test.
b. Polarity test.
c. Megger secondary winding at 500VDC.
d. Over Potential test at voltage recommended by the manufacturer.

3. Perform the following tests on all the switchgear bus sections:
   a. All bus connections shall be inspected. Check for loose connections, missing or damaged components. Torque all connections and terminations to the manufacturer's specifications.
   b. The switchgear bus shall be given a phase-to-phase and phase-to-ground Megger test at 1000VDC, with all the breakers open and all potential transformers fuses removed.
   c. Perform phasing check to ensure proper bus phasing from each source.
   d. Perform an overpotential test on each bus section in accordance with manufacturer's instructions.

4. Perform insulation resistance test on control wiring. (Do not perform this test on wiring connected to solid-state components).

5. Perform control wiring performance test. Use the elementary diagrams of the switchgear to identify each remote control and protective device. Conduct tests to verify satisfactory performance of each control and tripping function.

6. Perform current injection tests on the entire over-current circuit in each section of switchgear, including the ground and test device, to check fault operation for protection.

7. Verify operation of the over-current relays to make sure that the relays trip only as specified.

8. Verify the proper output level and polarity at each transducer.

9. Confirm phasing receptacle connections by the battery pulse method from the primary of the voltage transformer.

10. Check all meters at mid-scale for accuracy. Verify multipliers.

11. All protective relays shall be tripped (either manually or electrically) to determine whether the proper breaker has functioned as intended and any device or devices (including alarm, horns) have also operated correctly.

12. Clean, calibrate and test all protective relays. All relay settings shall be in accordance with the values furnished and/or approved by the Port Construction Representative.

13. Voltmeters shall be checked against potential transformer ratios. Where applicable, pointers shall be set on zero scale. With no voltage, voltmeter reading shall be checked with test voltmeter after energizing.

14. Watt meters and watt-hour meters shall be checked for proper current and potential transformer ratios. Where applicable, pointers shall be set on zero scale with no load and energized to check for proper rotation of meter.

15. All test results shall be in accordance with the requirements of all applicable test standards.

16. All switchgear shall be given operational tests. This shall include mechanical operation as well as operation by control circuit relays and tripping devices. Operating voltage at closing and tripping coils shall be checked to determine that voltage is of proper value.

17. The Contractor shall adjust and set all over-current trip devices, shunt trip devices and alarm devices in accordance with values determined.

C. Medium Voltage Circuit Breakers and Ground & Test Devices: The following tests shall be performed on the Medium Voltage Circuit Breakers, Loop Switches, and Ground & Test Devices. The term "Breaker" in the following tests represents Medium Voltage Circuit Breakers, Vacuum loop switches used for over-current protection and Ground & Test Devices.
1. Measure contact resistance by a Digital Low Resistance Ohmmeter (DLRO). Any contact resistance over 100 micro-ohms should be investigated and remedial action shall be performed.

2. Perform minimum pick-up voltage tests on the trip and close coils.

3. Each Breaker shall be given a Megger test in the test, open and closed positions. A 5000 Volt motor-driven Megger shall be used. Megger tests shall be applied between each phase to ground, between phases and between Line and Load sides. All test readings shall be recorded.

4. Perform an overpotential test, at a voltage recommended by the Breaker manufacturer, in the closed position. Test each phase to ground with all other phases grounded and across open contacts of each phase.

5. Perform insulation resistance test at 1000 volts DC on the Breaker control wiring. (Do not perform the test on wiring connected to solid-state components).

6. With the Breaker in the test position, or with no loads connected, perform the following tests:
   a. Trip and Close the Breaker with the control switch at least ten (10) times. All indication lights, annunciations, alarms, and targets shall be observed to determine correct operation. The Breaker mechanism shall be observed for correct alignment, freedom of binding and good contact.
   b. Trip each Breaker by manually operating each of its protective relays.
   c. Test the Breaker anti-pump circuit as recommended by the manufacturer.

7. Where applicable, all breakers shall be operated through at least three (3) Open-Close cycles in the racked-in position by manual operation and via control circuits, from each control point. All indication lights, annunciations, alarms, and targets shall be observed to determine correct operation. The breaker mechanism shall be observed for correct alignment, freedom of binding and good contact.

D. Medium Voltage Liquid Filled Transformers

1. Perform insulation power factor test and excitation current test using the test procedures and “Sweep Frequency Response Analyzer” equipment manufactured by Doble Engineering or, approved substitute. Furnish values of the Power Factor, Capacitance, Excitation Current, and Watt Loss.

2. Perform overpotential test in accordance with the applicable ANSI and NEMA standards.

3. Insulating liquid shall be sampled in accordance with ASTM D-923. Sample shall be laboratory tested for:
   a. Dielectric breakdown voltage
   b. Acid neutralization number
   c. Specific gravity
   d. Interfacial tension
   e. Color
   f. Visual condition
   g. Water content in PPM
   h. PCB content

4. Perform ratio, polarity, and insulation resistance and magnetization curve tests on the bushing current transformers.

5. Perform ratio, polarity, and insulation resistance on any voltage transformers installed on the transformer.

6. Check all the gauges and protective devices on the transformer for their intended functions.
7. Record Nitrogen pressure and verify with the manufacturer's recommended pressure.
8. Perform Turn-to-Turn ratio test on all the taps of the transformer.
9. Check the operation of the automatic tap changer.
10. Verify the terminal markings with the nameplate and the applicable ANSI standard.
11. Check operation of fans, pumps, etc.

E. Medium Voltage Disconnect Switches including Loop Switches

1. Measure contact resistance with a Digital Low Resistance Ohmmeter. If the contact resistance is above 100 micro ohms, repeat the test after cleaning and re-adjusting the contacts.
2. Apply overpotential between each phase and ground with the switch in the closed position. The remaining two phases should be connected to ground while testing the third phase. Test across open contacts of each phase.
3. Apply overpotential between phases and between line and load sides of the switch with the switch in the OPEN position.
4. Operate the switch at least ten (10) times to check its mechanical operation.
5. Check the mechanical, electrical, and key interlocking features between the subject disconnect switch, grounding switch and any upstream and downstream circuit breakers or disconnect switches.
6. Where applicable, verify the fuse size and rating as per specifications and Contract Drawings.
7. Where applicable, check the operation and intended purpose of the Blown Fuse Indicator.
8. Where applicable, check the fuse for continuity and damage and check the fuse holder for adequate mechanical support for each fuse.
9. Check blade alignment and arc interrupter operation

F. Medium Voltage Dry Type Transformers

2. Perform over potential test as approved by the manufacturer. Measure insulation resistance at intervals of 30 seconds, 1 minute, and 10 minutes. Calculate Dielectric Absorption Ratio and Polarization Index.
3. Perform turn ratio test between windings at each available tap.
4. Verify the terminal markings with the nameplate and applicable ANSI standards.
5. Test the lightning arrestors
6. Measure core to ground resistance
7. Check the operation of the cooling fans.
8. Check the temperature control unit and set the unit for the operation of fans, initiation of alarms and trip functions. Verify each control function.
9. Check the ratio, polarity, insulation resistance and magnetization curves any current transformers installed inside or outside the transformer enclosure.
10. Check the ratio, polarity and insulation resistance of any voltage transformers installed inside or outside the transformer enclosure.
11. Perform winding resistance test for each winding at as found tap position.
12. Record reading of operation counter (where applicable).
13. Check breaker cubicle for ground bus connections.
14. Check shutters for proper operation.
15. Check auxiliary switch assembly for proper operation.
16. Inspect cables for proper terminations.

G. Medium Voltage Insulated Power Cables

1. All medium voltage cables should be Hi-Potential tested by the following method outlined herein at a voltage recommended by the manufacturer. These tests shall be performed with all safety precautions and proper preparation of the cable ends. “Each phase conductor of the cable shall be subjected to the Hi-Potential test to ground with the other two phases grounded together with the ground shields. Applied potential shall be increased in steps of 5KV by holding the voltage for one minute at each step. At the end of each minute, leakage current shall be recorded. After reaching the intended voltage level, the voltage shall be held for at least ten minutes and the leakage current shall be recorded at the end of each minute.” If the test indicates excessive leakage current, as determined by the cable manufacturer for the specific type of cable being installed, discontinue the test and notify the Port Construction Representative. Discharge each cable of the capacitive charge by grounding the cable until the cable is completely discharged and remains discharged.

2. All medium voltage cable splices shall be witnessed, recorded, photographed, and certified by testing agency. Submit report as part of the hi-potential test results.

3. Check continuity of the cable shield and measure its resistance for the entire length of the cable.

4. Check for proper terminations.

H. Protective Relays:

1. Check relay contacts.

2. Perform testing and calibration of relays.

   a. Apply relay settings.
   b. Calibrate relays.

3. Verify that relays perform their intended functions.

I. Signage: Verify all NEC required safety signage has been installed, including high voltage and arc flash warning signs, per NEC Article 100.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL
SECTION 26 08 00.00 Add – FIELD TESTING

PART 1 GENERAL

1.1 DESCRIPTION

A. Subject to the General and Special Conditions, this Section includes specifications for testing the complete electrical installation except the primary 12.47 kV distribution system. (See Section 26 08 00.01 – "Medium Voltage System Commissioning Tests" for 12.47 kV testing requirements.)

B. The 120, 240, 208, and 480-volt electrical systems shall be tested by an outside experienced testing company engaged by the Contractor.

1. Emerson Process Management
2. Eaton
3. ECP Tech Services
4. Or as pre-approved in writing.

1.2 REFERENCES

A. National Electrical Codes (NEC): NEC Article 110 - Requirements for Electrical Installations.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, and details as may be required by the Port Construction Representative, including testing methods. At the minimum, the following are required.

1. Samples of proposed test report forms for the various types of tests indicated herein prior to commencement of field testing.
2. Test reports shall include but not be limited to the following: date; testing personnel names; wet and dry bulb temperatures; description of item tested; type of tests performed; equipment used for testing; results of tests.

C. Notification for all testing except megger testing requires that all test results be submitted to the Port Construction Representative.
D. The name, address, and telephone number of the proposed testing company to be engaged for testing the electrical system, together with their references and samples of recent test results and reports.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 MATERIALS, EQUIPMENT AND PERSONNEL

A. The Contractor shall provide the following:

1. Qualified personnel to conduct all testing.
2. Labor, temporary power, lighting, wiring, and materials required for testing.
3. Submit nameplates and label legends as required in Section 26 05 53 - Electrical Identification for approval by the Port Construction Representative. All abbreviations and titles shall be checked for clarity.

B. Test Equipment: The Contractor shall furnish all test equipment, which shall include but not be limited to the following:

1. Submit nameplate and label legends to be approved by Port Construction Representative. Abbreviations and titles must be checked for clarity.
2. Wet and dry bulb thermometer.
3. Meggers by James G. Biddle Co., or Associated Research, Inc., or approved substitution, suitable for 120, 208, 240, and 480 volt and systems testing. Use instruments rated at voltages recommended by Material and Equipment Manufacturers.
4. Portable radios.
5. A Simpson Model 260 Volt-Ohm-Millimeter, or approved substitution.
6. A phase sequence and rotation meters rated at 600 volts, 30-60 hertz, by Knopp, Inc., or approved substitution for the 120, 208, 240, and 480-volt systems.
7. A commercial model, three point, ground test by James G. Biddle Co., a "Vibroground" tester by Associated Research, Inc., or approved substitution.

C. The Contractor shall furnish and use safety devices such as rubber gloves and blankets, protective screens and barriers, danger signs, etc., to adequately protect and warn all personnel in the vicinity of the tests.

D. Test equipment, material, and labor for electrical system testing execution. Test shall be by the outside testing agency engaged for this purpose.
PART 3  EXECUTION

3.1  GENERAL

A. All testing to be performed in compliance with NETA Acceptance Testing Specifications. All submitted test results must include statement indicating compliance.

B. Prior to start of testing the installation shall be completed, punch listed and inspected by the Port Construction Representative for satisfactory completion of work.

C. Under no circumstances, testing shall begin without the prior approval of Port Construction Representative.

D. Testing for 480-volt system also shall be approved by the Port Construction Representative.

E. Testing may be witnessed by the Port Construction Representative. Provide 1 week advanced notice accordingly.

F. Provide all reports bound in a three (3) ring binder and assembled in a professional format. Send a single preliminary report for the Chief Engineer’s review and comments then, send six (6) copies of the final bound report to Port Construction Representative.

3.2  TESTING

A. Molded Case Breaker Tests: The tests shall include the following:

1. Check adjustable magnetic trip settings against values furnished by the Port Construction Representative.
2. Megger each pole for freedom from grounds.
3. Check connections and tighten as required.

B. Tests on Motor Starters and Contractors: Tests shall include the following:

1. Check equipment grounding to assure continuity of connections.
2. Remove any blocking used for shipment.
3. Check overload relays for proper current range with motor nameplate full load amperes. Adjust relays for manual or automatic reset.
4. Check each magnet coil for proper operating voltage.
5. Check auxiliary contacts for correct arrangement with coil de-energized; i.e.; normally open or normally closed.
6. Megger each pole of the starter or contractor for freedom from grounds.
7. Check fuses and/or circuit breakers for proper ratings as prescribed by the manufacturer for the actual motor supplied.
8. Check overload heater relays or other overload protection for proper ratings as prescribed by the manufacturer.
9. Check wiring connections and tighten as required
10. Check secondary fuses for proper ratings for motor starter control power transformers.

C. Inspection of Disconnect Switches:

1. Inspect contacts, clean as required.
2. Inspect arc chutes.
3. Inspect fuses for proper rating, type, and size.
D. Lighting System Tests:

1. Test lighting systems for proper operation, for conformance with indicated switch control on the Drawings, for dimming, etc.
2. Set time clocks with astronomical dials to turn "ON" at sunset and "OFF" at sunrise and test operation.
3. Perform site measurements to ascertain lighting levels obtained characteristically match those previously calculated as required by Section 26 56 29 - High Mast Lighting System. Take one set of measurements between all light masts at the wharf's edge; take three readings between light masts at the Phase A1 perimeter bordering the Eastern Residential Area; and take six readings within the yard also between light poles. Prepare a report including diagrams of both the calculated footcandle values prepared and the measured values at the areas described and submit as required under paragraph 1.3 of this specification.

E. 600-Volt Wire and Cable Tests:

1. 600-volt wire shall be meggered with a 1000 volt megger for one minute, and values must be approximately as listed as follows:

<table>
<thead>
<tr>
<th>Conductor Capacity</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ohms</td>
</tr>
<tr>
<td>0 - 24</td>
<td>1,000,000</td>
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<tr>
<td>25 - 50</td>
<td>250,000</td>
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<td>51 - 100</td>
<td>100,000</td>
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<td>101 - 200</td>
<td>50,000</td>
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<td>201 - 400</td>
<td>25,000</td>
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<tr>
<td>501 - 800</td>
<td>12,000</td>
</tr>
<tr>
<td>Over - 800</td>
<td>5,000</td>
</tr>
</tbody>
</table>

The above values shall be determined with switchboards, panel boards, fuse holders, switches, and over current devices in place. Devices containing semiconductors, such as diodes, transistors, and other devices, which can be damaged by the megger shall not be connected during meggering. Motors and transformers shall not be connected during meggering. Wire and cable shall be meggered after installation, not on the reel.

2. Wiring to be meggered shall be limited to feeder wiring between main distribution equipment and power panels, branch circuit panels, motor control centers, individual pieces of mechanical equipment and other similar equipment. Wiring for mechanical equipment connected to branch circuit panels shall also be meggered. Branch circuit wiring for lighting and receptacles shall not be meggered.

3. The Contractor shall perform all phasing tests and shall make changes necessary to assure proper rotation of all motors, the correct phasing and phase sequence of all circuits susceptible of being paralleled, the proper polarity on all instrument transformer wiring, and such other phasing tests and changes as may be required for the equipment being connected under this Contract.
F. Panelboards:
   1. Test breaker ON/OFF operation.
   2. Test voltages between phase and phase to ground at:
      a. Before incoming breaker.
      b. After the incoming breaker at the bus.
      c. At all feeder breakers.
   3. Record all test results.

G. Miscellaneous Equipment Tests: Test all miscellaneous equipment for proper operation in accordance with equipment manufacturer’s instructions.

H. See Section 26 08 00.01 – "Medium Voltage System Commissioning Tests" for additional requirements for testing 12.47 kV system.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 11 16.00 Add – UNITIZED TRANSFORMER STATION

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specification for
unitized transformer sub-stations.

1.2  REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C37.121 (1989; R 1995) - Switchgear - Unit Substations.
   2. ANSI C57.12.13 (1982) - Liquid-Filled Transformers Used in Unit Installations,
      Including Unit Substations.
   3. ANSI C57.12.22 (1993) - Requirements for Transformers-- Pad-Mounted,
      Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers with
      High-Voltage Bushings, 2500 kVA and Smaller: High-Voltage, 34 500 GrdY/19
      920 Volts and Below; Low Voltage, 480 Volts and Below.
   4. ANSI C57.12.28 (1988; Correction 1988) - Switchgears and Transformers - Pad-
      Mounted Equipment - Enclosure Integrity.
   5. ANSI C57.12.29 (1991) - Switchgear and Transformers - Pad-Mounted
      Equipment - Enclosure Integrity for Coastal Environments.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A167 (1999) - Stainless and Heat-Resisting Chromium-Nickel Steel Plate,
      Sheet, and Strip.
   2. ASTM A780 (2000) - Repair of Damaged and Uncoated Areas of Hot-Dip
      Galvanized Coatings.

C. Factory Mutual Engineering and Research (FM):

D. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE 386 (1995) - Separable Insulated Connector Systems for Power
      Distribution Systems above 600 V (ANSI/IEEE).
   3. IEEE C37.20.3 (1987; R 1992) - Metal-Enclosed Interrupter Switchgear
      (ANSI/IEEE).
      Protective Relays and Relay Systems.
   5. IEEE C57.12.00 (2000) - Liquid-Immersed Distribution, Power, and Regulating
      Transformers (ANSI/IEEE).

E. National Electrical Manufacturers Association (NEMA):

5. NEMA ST 20 (1992) - Dry-Type Transformers for General Applications.


I. Section 16460 – “Transformers.”

1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At minimum, the following are required.

1. Completed manufacturers' literature and data sheets.
2. Manufacturers cut sheets and catalog.
3. Impulse voltage test record and BIL ratings.
4. Complete nameplate data including impedance tap-voltage data and losses at 50, 75, and 100 percent loads.
5. Installation terminating & splicing procedures.
6. Instructions for handling and storage.
7. Dimensions and weight.
8. Test certificates.

C. As an exception to the transformer submittal requirements specified herein, liquid-filled transformers manufactured by the firms listed under Part 2 “Manufacturers” need not meet the submittal requirements of this contract. Instead, the following shall be submitted:
1. A certification, from the manufacturer, that the technical requirements of this specification shall be met.
2. An outline drawing of the transformer with devices identified (paragraph entitled "Transformer Drawings," item a.).
3. ANSI nameplate data of the transformer (paragraph entitled “Transformer Drawings,” item b.).
4. Routine and other tests (paragraph entitled "Routine and Other Tests"), shall be conducted by the manufacturer, and may be witnessed by the Port Construction Representative (paragraph entitled "Source Quality Control"). Provide transformer test schedule required by submittal item "Closeout Submittals." Provide certified copies of the tests.
5. Provide acceptance test reports required by submittal item "Test Reports."
6. Provide operation and maintenance manuals required by submittal item "Operation and Maintenance Data."

D. Coordinated Submittal Reviews:

1. Submit transformer submittals to Port Construction Representative for approval. In addition, submit one set of the remaining substation components for surveillance.
2. Submit remaining substation component submittals to Chief Engineer for approval. In addition, submit one set of transformer submittals for surveillance and to insure alignment of equipment and coordination for interconnections.
3. Drawing approval is a MUST to start manufacture of Unit Substation & Transformers.

E. Unit Substation Drawings:

1. Transformer drawings to Port Construction Representative:
   a. Product Data including voltage ratios, full load current, impedance, and losses.
   b. Secondary unit substation excluding transformer data.
   c. Unit substation transformer, liquid-filled to Port Construction Representative.
   d. Submittal shall include manufacturer's information for each component, device, and accessory provided with the equipment.
2. Test Reports:
   a. Acceptance checks and tests.
   b. Submit report of acceptance test results as specified by paragraph entitled "Field Quality Control."
3. Certificates:
   a. Paint coating system.
   b. Transformer losses.
4. Manufacturer's Field Reports:
   a. Vacuum Loop Switch – Circuit Breaker. (An integral part of transformer assembly.)
   b. Unit substation transformer design tests, liquid-filled to Port Construction Representative.
   c. Unit substation transformer routine and other tests, liquid-filled to Port Construction Representative.
5. Operation and Maintenance Data:
   a. Unit substations, Data Package.
   b. Submit Operation and Maintenance Manuals.
6. Closeout Submittals:
   a. Assembled Operation and Maintenance Manuals.
b. Equipment test schedule to Port Construction Representative.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. Drawing Requirements:

1. Unit Substation Drawings: Drawings shall include, but are not limited to the following:
   a. An outline drawing, with front, top, and side views showing incoming, transformer, and outgoing sections.
   b. One-line diagram showing incoming section, transformer, current transformers, meters, relays, distribution panel, and ampere rating of all bus bars.
   c. Elementary diagrams and wiring diagrams with terminals identified, and indicating pre-wired interconnections between items of equipment and the interconnection between the items.
   d. Provisions for future extension

C. Transformer Drawings: Drawings shall include, but are not limited to the following:

1. An outline drawing, with front, top, and side views.
2. ANSI nameplate data.

D. Paint Coating System: Submit NEMA C57.12.28 coating system performance requirement tests. When switchgear and transformer are provided by two different manufacturers, each one shall provide certification.

E. Transformer Losses: Submit certification from the manufacturer indicating conformance with the paragraph entitled "Specified Transformer Losses.

F. Maintenance:

1. Assembled Operation and Maintenance Manuals: Manuals shall be assembled in durable, hard covered, water resistant binders. The manual shall be assembled and indexed in the order noted in a table of contents. The contents of the assembled operation and maintenance manuals shall be as follows:
   a. Manufacturer's O&M information required by the paragraph entitled, "Operation and Maintenance Data."
   b. Catalog data required by the paragraph entitled, "Product Data."
   c. Drawing required by the paragraph entitled, "Shop Drawings."
   d. Price for spare parts and supply list
   e. Routine and field acceptance test reports

1.5 MEASUREMENT AND PAYMENT

A. Payment for 'Unitized Transformer Station' shall be on a lump sum basis for the complete station, including material, equipment, labor, and all other incidentals required, complete in place and accepted.

PART 2 PRODUCTS
2.1 LIST OF MANUFACTURERS

A. Transformer:
   1. Cooper Power Systems in Waukesha, WI.
   2. Or pre-approved substitution.

B. Primary Incoming Section:
   1. Cooper Power Systems, Milwaukee, WI.
   2. Or pre-approved substitution.

C. Secondary Distribution Section:
   1. General Electric, Plainville, CT.
   2. Eaton/Cutler-Hammer, Milwaukee, WI.
   3. Siemens, Oklahoma City, OK.
   4. Or approved substitution.

2.2 PRODUCT COORDINATION

A. Products and materials not considered to be secondary unit substations and related accessories are specified in Section 16123, "Medium Voltage Power Cable."

B. All required fault indicators and rubber goods shall be provided for Unitized Substation and related switch.

2.3 MATERIALS AND EQUIPMENT

A. Secondary Unit Substation: Secondary Unit substations shall comply with ANSI C37.121 regardless of the kVA rating specified. Substation shall consist of one incoming section, one transformer section, and one outgoing section. Substation shall be designed for outdoor service with ventilation openings and gasketing provided to ensure a weatherproof assembly under rain, snow, sleet, and hurricane conditions. External doors shall have provisions for padlocking.

B. Incoming Section: The incoming section shall consist of a metal-enclosed compartment for dead front termination of the 15kv power cables.

   1. Incoming Section Enclosure:
      a. The incoming section enclosure shall be stainless steel in accordance with the provisions in Section 16476 – "Vacuum Loop Switch – Circuit Breaker Assembly." Paint enclosure, including bases, ASTM D1535 light gray No. 61 or No. 49. Paint coating system shall be consistent for all sections of the substation and shall comply with ANSI C57.12.29 regardless of base and substation material.
      b. The high-voltage compartment shall contain the incoming line, insulated high-voltage dead-break connectors, bushing well inserts, feed-thru inserts, high-voltage bushing wells configured for loop feed application, connector parking stands with insulated standoff bushings, protective caps, and ground pad.

   2. Cable Terminations: IEEE 386. Provide cable terminations of the modular molded rubber type. Insulated high-voltage connectors shall have steel reinforced hook-stick eye, grounding eye, and test point. Connectors as follows:
      a. 600 ampere dead break connector rating: Voltage: 15 kV, 95 kV BIL. Short time rating: 40,000 rms symmetrical amperes.
b. Parking stands: Provide a parking stand near each bushing well. Provide insulated standoff bushings for parking of energized load-break connectors on parking stands.

c. Protective caps: IEEE 386, 600 amperes, 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushing well inserts and insulated standoff bushings.

d. Provide one set of three grounding elbows for each secondary unit substation. Grounding elbows shall be delivered to the Chief Engineer or Port of Houston Authority’ Representative.


4. Vacuum Loop Switch – Circuit Breaker: Loop feed sectionalizer switches with circuit breaker tap: Provide as specified in Section 26 13 19.01 “Vacuum Loop Switch – Circuit Breaker Assembly” except built integral with transformer or transition section as indicated. The (2) Load break switches shall be make before break to allow operation without disruption of transformer power. Operation of switches shall be as follows:

<table>
<thead>
<tr>
<th>ARRANGEMENT No.</th>
<th>DESCRIPTION OF SWITCH ARRANGEMENT</th>
<th>SWITCH POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LINE A SW. OPEN</td>
</tr>
<tr>
<td>1</td>
<td>Line A connected to Line B and both lines connected to transformer</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Transformer connected to line A only</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>Transformer connected to line B only</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>Transformer open and loop closed</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>Transformer open and loop open</td>
<td>X</td>
</tr>
</tbody>
</table>

5. Transformer (Liquid-Filled) Section: ANSI C57.12.13; C57.12.22. Mineral oil liquid-filled. Transformer base, including the tank, radiators, flanges, base, lifting provisions, and hardware, shall be fabricated of ASTM A167 type 304, 304L, or 316 stainless steel. Transformer base shall include any part of the transformer that is within 3 inches of concrete pad. Paint coating system shall comply with ANSI C57.12.29, regardless of equipment material.

a. Transformer Ratings:
   1) Cooling Class: OA-Liquid-filled, self-cooled.
   2) Frequency: 60 Hz.
   3) Phases: Three phase.
   4) Rated Kilovolt Amperes: As indicated on the drawings
   5) Voltage Rating: 12.47kV – 480/277 V. Delta – Y. grounded. Transformers, provide transformer with five-legged core design for third harmonic suppression. (Provide impedance grounding resistor where indicated on plans.)
   6) Impedance: Minimum tested impedance shall not be less than specified in C57.12.22
   7) Insulation Level: 95 kV BIL
8) Temperature Rise: 65 degree C average winding temperature rise above a 30 degree ambient.

9) Audible Sound Levels: Audible sound levels shall comply with the following:

<table>
<thead>
<tr>
<th>KVA Range</th>
<th>Decibels</th>
</tr>
</thead>
<tbody>
<tr>
<td>225-300</td>
<td>55</td>
</tr>
<tr>
<td>301-500</td>
<td>56</td>
</tr>
<tr>
<td>501-700</td>
<td>57</td>
</tr>
<tr>
<td>701-1000</td>
<td>58</td>
</tr>
<tr>
<td>1001-1500</td>
<td>60</td>
</tr>
<tr>
<td>1501-2000</td>
<td>61</td>
</tr>
<tr>
<td>2001-2500</td>
<td>62</td>
</tr>
<tr>
<td>2501-3000</td>
<td>63</td>
</tr>
<tr>
<td>3001-4000</td>
<td>64</td>
</tr>
</tbody>
</table>

b. Transformer Accessories: The transformer shall have the following accessories:

1) Four (4) 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changer shall be off-load.

2) Tap changer, with external, pad-lockable, manual type operating handle, for changing tap setting when transformer is de-energized.

3) 600-ampere one-piece deadbreak apparatus bushings with connectors to bus work.

4) Insulated low-voltage neutral bushing with lugs for ground cable and removable ground strap.

5) Ground pads.

6) Liquid-level indicator.

7) Pressure-vacuum gage.

8) Liquid temperature indicator.

9) Drain and filter valves.

10) Pressure relief device, top mounted Qualitrol series 208.

11) Diagrammatic stainless steel nameplate.

12) Transformer base with provisions for jacking and for rolling in either direction.

13) Lifting provisions.

14) Bolted transformer top or welded top with bolted handhole access.

c. Insulating Liquid: Less-flammable transformer liquids: NFPA 70 and FM P7825 for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D92 and a dielectric strength not less than 33 kV tested per ASTM D877. Insulating fluid shall be biodegradable and 100% edible seed oil-based with food grade performance enhancing additives. It shall have a minimum open cup fire point (ASTMD92) of 350°C and a minimum 5-Day BOD (SM5210B) of 200ppm. The fluid shall be FM Approved, UL Classified less-flammable, all in accordance with current NEC Section 450-23. Do not provide askarel or insulating liquids containing polychlorinated biphenyls (PCB's) and tetrachloroethylene (perchloroethylene), chlorine compounds, and...
halogenated compounds. Provide identification on transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate. Cooper Power Systems Envirotemp FR3 or approved substitution.

d. Outgoing Section:

1) The outgoing section shall consist of a secondary transition section with connections to a low-voltage switchboard. The outgoing section enclosures shall be NEMA ICS 6 Type 3R, fabricated entirely of ASTM A167 type 304 or 304L stainless steel, unless indicated otherwise on drawings. Connections between the transformer secondary bushings and the outgoing section transition bus shall be flexible braid bus. The secondary transition section shall have a hinged front panel. Connections using cables and conduits routed outside of the enclosures are not allowed.

2) Outgoing Section Enclosure: Provide outgoing section enclosure to match remainder of substation equipment and be in accordance with the requirements in paragraph entitled, "Incoming Section Enclosure."

3) Coordinate outgoing section enclosure size and bus arrangement with requirements of Section 26 09 13.00 – "Automatic Power Factor Correction," Paragraph 2.3 entitled "AUTOMATIC POWER FACTOR CORRECTION SYSTEM," where Automatic Power Correction Unit (APFCU) is installed on load side of transformer station and where APFCU C.T.'s are to be remote located from APFCU enclosure.

e. Protective Relaying, Monitoring and Metering:

1) The Vacuum Loop Switch Incoming Section shall include equipment for protective relaying, monitoring, and metering the tap circuit to the transformer. The loop feed-through circuit will contain none of this equipment. The protective relaying, monitoring and metering equipment shall be comprised of an integrated module containing feeder management elements as specified Section 26 13 19.01 – "Vacuum Loop Switch Circuit Breaker Assembly", Paragraph 2.3, Item C. The integrated module shall be a Cooper Model IDP-210 relay or an approved substitute.

2) The Contractor shall provide the services of a qualified, factory trained technical support and startup of the equipment specified in the above paragraph. The Representative shall also provide a training session at the construction site as stipulated under “Training” at the end of this section.

6. Current Transformers: IEEE C57.13. Transformers ratio shall be 1000:1, 60 hertz, full load amps plus 25%, integral CT for the IDP-210 relay, rating factor to be 3.0 for ratings of 800 amps or less and 1.5 for ratings 1200 Amps and above, with a metering accuracy class in accordance with IEEE C57.13. Note: Allow for additional C.T. installation on bus or cables where APFCU is to be installed on load side of transformer per Section 26 09 13.00 – “Automatic Power Factor Correction.”

7. Voltage Transformers: Transformer shall conform to the requirements of the meter manufacturer’s standards.

8. Heaters: Provide 120-volt heaters in incoming section and outgoing section. Heaters shall be of sufficient capacity to control moisture condensation in the
compartments, shall be 250 watts minimum, and shall be controlled by a thermostat and humidistat located in each section. Thermostat shall be industrial type, high limit; to maintain compartments within the range of 60 to 90 degrees F. Humidistat shall have a range of 30 to 60 percent relative humidity. If heater voltage is different from substation equipment voltage, provide transformer rated to carry 125 percent of heater full load rating. Transformer shall have 220 degrees C insulation system with a temperature rise not exceeding 115 degrees C and shall conform to NEMA ST 20. Energize electric heaters while the equipment is in storage or in place prior to being placed in service. Provide method for easy connection of heater to external power source.

9. Insulated Barriers: Where insulated barriers are required by reference standards, provide barriers in accordance with NEMA LI 1, Type GPO-3, 0.25-inch minimum thickness.

10. Terminal Boards: Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Terminal boards associated with current transformers shall be short-circuiting type. Terminate conductors for current transformers with ring-tongue lugs. Terminal board identification shall be identical in similar units. External wiring shall be color coded consistently for similar terminal boards.

11. Wire Marking: Mark control and metering conductors at each end. Provide factory-installed, white, plastic tubing, heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide white, preprinted, polyvinyl chloride (PVC) sleeves, heat stamped with black block type letters. Each sleeve shall contain a single letter or number, shall be elliptically shaped to securely grip the wire, and shall be keyed in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Each wire marker shall indicate the device or equipment, including specific terminal number to which the remote end of the wire is attached.

2.4 NAMEPLATES

A. Provide as specified in Section 26 05 53.00, "Electrical Identification."

B. Warning Signs: Provide as specified in Section 26 05 53.00– "Electrical Identification."

C. Source Quality Control:

1. Equipment Test Schedule: The Authority reserves the right to witness tests. Provide equipment test schedules for tests to be performed at the manufacturer's test facility.

Submit required test schedule and location, and notify the Port Construction Representative 30 calendar days before scheduled test date. Notify Port Construction Representative 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration:

1) The manufacturer shall have a calibration program, which assures that all applicable test instruments are maintained within rated accuracy.

2) The accuracy shall be directly traceable to the National Institute of Standards and Technology.

3) Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.
4) Dated calibration labels shall be visible on all test equipment.
5) Calibrating standard shall be of higher accuracy than that of the instrument tested.
6) Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:
   a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.
   b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2. Incoming Switch Assembly Design and Production Tests: Furnish documentation showing the results of design tests on a product of the same series and rating as that provided by this specification. Furnish reports of production tests performed on the actual equipment for this project in accordance with Specification Section 16476 “Vacuum Loop Switch – Circuit Breaker Assembly.

3. Transformer Routine and Other Tests (Liquid-Filled): In accordance with IEEE C57.12.00 and IEEE C57.12.90. Routine and other tests shall be performed by the manufacturer on each of the actual transformers prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence shall be as follows:
   a. Cold resistance measurements (provide reference temperature).
   b. Phase relation.
   c. Ratio.
   d. Insulation power-factor by manufacturers recommended test method.
   e. No-Load Losses (NLL) and excitation current.
   f. Load losses (LL) and impedance voltage.
   g. Dielectric.
   1) Impulse: Per IEEE C57.12.90, paragraph 10.3 entitled “Lightning Impulse Test Procedures,” and IEEE C57.98. Test the primary winding only.
      a) State test voltage levels
      b) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test reports. As an alternative, photographs of oscilloscope display waveforms or plots of digitized waveforms may be hand-delivered at the factory witness test.
   2) Applied voltage
   3) Induced voltage.
   h. Leak: Leak test shall be performed in accordance with the manufacturer’s standard.
2.5 TERMINATION DEVICES

A. Provide wiring terminals and cable lugs of adequate size and quantity to accommodate all of the required conductors and cables.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

B. Grounding: NFPA 70 and IEEE C2, and Section 26 05 26.00 – "Basic Grounding and Bonding."

3.2 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

A. General: Install and connect unit substations furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

B. Incoming Switchgear: IEEE C37.20.3.


D. Galvanizing Repair: Repair damage to galvanized coatings using ASTM A780, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied too.

3.3 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

A. Exterior Location: Mount unit substation on concrete slab. Unless otherwise indicated, the slab shall be at least 8 inches thick, reinforced with a 6 x 6 - W2.9 x W2.9 mesh placed uniformly 4 inches from the top of the slab. Slab shall be placed on a 6-inch thick, well-compacted gravel base. Top of concrete slab shall be approximately 4 inches above the finished grade. Edges above grade shall have 1/2 inch chamfer. The slab shall be of adequate size to project at least 8 inches beyond the equipment and shall be constructed to fit the equipment provided. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 inches above slab surface. Concrete work shall be as specified in Section 03 30 00.00 – Cast-in-place Concrete.

3.4 FIELD QUALITY CONTROL

A. Performance of Acceptance Checks and Tests: Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS and, according to requirements of Section 26 08 00.01 – "Medium Voltage System Commissioning Tests" in its entirety.
1. Incoming Switchgear:
   a. Visual and Mechanical Inspection:
      1) Compare equipment nameplate data with specifications and approved shop drawings.
      2) Inspect physical and mechanical condition.
      3) Confirm correct application of manufacturer's recommended lubricants.
      4) Verify appropriate anchorage and required area clearances.
      5) Verify appropriate equipment grounding.
      6) Verify correct mechanical operation.
      7) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
      8) Test interlocking systems for correct operation and sequencing.
      9) Inspect all indicating devices for correct operation
   b. Electrical Tests:
      1) Perform insulation-resistance tests.
      2) Perform over-potential tests.
      3) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.
      4) Measure contact-resistance across each switch contact
      5) Verify heater operation.

2. Transformers (Liquid-Filled):
   a. Visual and Mechanical Inspection:
      1) Compare equipment nameplate data with specifications and approved shop drawings.
      2) Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.
      3) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
      4) Verify correct liquid level in transformer tank.
      5) Perform specific inspections and mechanical tests as recommended by manufacturer.
      6) Verify correct equipment grounding.
      7) Verify the presence of transformer surge arresters.
   b. Electrical Tests:
      1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.
      2) Perform insulation-resistance tests.
      3) Perform turns-ratio tests.
      4) Perform insulation power-factor/dissipation-factor tests on windings.
      5) Sample insulating liquid. Sample shall be tested for:
         a) Dielectric breakdown voltage
         b) Acid neutralization number
         c) Specific gravity
         d) Interfacial tension
         e) Color
         f) Visual condition
g) Water in insulating liquid
h) Measure dissipation factor or power factor.
6) Perform dissolved gas analysis (DGA).
7) Test for presence of PCB.
8) Verify that the tap-changer is set at specified ratio.
9) Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

3. Current and Voltage Transformers:
a. Visual and Mechanical Inspection:
   1) Compare equipment nameplate data with specifications and approved shop drawings.
   2) Inspect physical and mechanical condition.
   3) Verify current transformer ratio.
   4) Verify correct connection.
   5) Verify that adequate clearances exist between primary and secondary circuit.
   6) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
   7) Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests:
   1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
   2) Perform insulation-resistance tests.
   3) Perform polarity tests.
   4) Perform ratio-verification tests.

4. Relaying Metering and Instrumentation:
a. Visual and Mechanical Inspection:
   1) Compare equipment nameplate data with specifications and approved shop drawings.
   2) Inspect physical and mechanical condition.
   3) Verify tightness of electrical connections.

b. Electrical Tests:
   1) Verify accuracy of instruments at 25, 50, 75, and 100 percent of full scale.
   2) Calibrate instruments according to manufacturer's published data.
   3) Verify all instrument multipliers.
   4) Verify that current transformer and voltage transformer (if installed) secondary circuits are intact.

5. Grounding System:
a. Visual and Mechanical Inspection: Inspect ground system for compliance with contract plans and specifications.
b. Electrical Tests: Perform ground tests in accordance with Section 26 05 26.00 – Basic Grounding and Bonding.

B. Follow-Up Verification: Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Test shall require each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, the Port Construction Representative shall
be given 5 working days’ advance notice of the dates and times for checks, settings, and tests.

C. Training:

1. Provide training sessions at the Construction site for a number of Port of Houston Authority personnel for a minimum of one (1) eight (8) hour day or as required by the Port Construction Representative.

2. The training session for the Relaying Equipment shall be conducted by that equipment’s manufacturer, for the Vacuum Loop Switch by its manufacturer and for the Transformer/Switchboard equipment by the Contractor. The training session may be combined with that specified for the Vacuum Loop Switch Circuit Breaker Assembly in Section 26 13 19.01, Vacuum Loop Switch Circuit Breaker Assembly.

3. The training program shall consist of instructions for start-up, testing, operating, and troubleshooting of the specified equipment as well as the means and requirements for remote communications. Full documentation and software shall be introduced and provided at the sessions as follows:
   a. Training Manual
   b. Standard Manual for Operation and Maintenance, Testing and Troubleshooting
   c. Software with Documentation for training, operation and maintenance, and troubleshooting
   d. Full documentation for Remote Communication to permit Monitoring, Data Retrieval, changing set points and executing Commands for future use by the Port of Houston Authority.
   e. Parts List and Recommended Spare Parts.

END OF SECTION
PART 1  GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specification for three-phase, group operated, 60 Hz, padmount, load and fault interrupting vacuum switch assembly, Envirotemp FR3 fluid insulated, with maximum ratings of 600 A and 15.5 kV, and utilizing separable insulated connectors. The assembly, hereinafter designated as a “Loop-Tap Switch,” shall contain overcurrent and other relay and fault-indicating equipment as specified.

1.2 REFERENCES


B. Institute of Electrical and Electronics Engineers (IEEE):

1. 386-1995 IEEE Standard for separable insulated connector system for power distribution systems above 600 volts.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following details are required.

1. Overall dimensions.
2. Shipping packaging.
3. Identification of units.
4. Unit locations.
5. Locations of incoming and outgoing line bushings.
7. Available conduit entrance areas.
8. Bushings and Bushing Stands; Phase and Ground.

C. Schematic and elementary diagrams for individual unit, and master terminal boards consisting of drawings, which identify:

1. Electrical devices.
2. Electrical connections.
3. Terminal numbering designations.
4. Name plate data and complete electrical ratings.

D. Documentation for the installation, operation, and maintenance of solid state protective relaying, monitoring and metering equipment that clearly demonstrates the equipment’s ability to function as intended in this project.

E. Catalog Cuts:

1. Vacuum switches.
2. Nameplates.
3. Overcurrent Relays.
4. Metering equipment.
5. Circuit breakers.
6. Ground check relay.
7. Connection bushings and test point connectors.
8. Other factory or field mounted devices shown on the Contract Drawings or as required for operation of equipment.

F. Manufacturer's certifications.

G. At time of acceptance of the Loop-Tap Switch Assembly, deliver all copies of all software with associated documentation for the installation, operation, maintenance and troubleshooting for all of the digital equipment installed.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Loop tap switch assemblies shall be delivered with all electrical devices, including but not limited to circuit breakers, switches, relays, fault indicators and control power transformers shall be in place and wired. Packaging materials shall be arranged to prevent damage to components due to vibration, jarring, and the like during transportation and handling.

B. Electrical devices shipped loose shall be delivered in the manufacturer's original unopened protective packaging and shall be identified with suitable, non-corrosive tags.

C. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of the final cleaning up.
D. Touch up any damage to finishes to match adjacent surfaces.

1.6 MEASUREMENT AND PAYMENT

A. No separate payment for this item. Payment for “Vacuum Loop Switch – Circuit Breaker Assembly” shall be included as part of the complete unitized substation, BSS-4 in accordance with Specification 26 11 16.00.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Trayer Engineering Corp.
B. Cooper Power Systems.
C. Or pre-approved (in writing) substitution.

2.2 DEFINITIONS

A. The definitions of terms contained in this specification, or in other standards referred to in this document, are not intended to embrace all the legitimate meanings of the terms. They are applicable only to the subject treated in this specification.

1. Bus (as used in this specification): A three-phase junction common to two or more ways.
2. Way: A three-phase circuit entrance to a switching assembly.
3. Switched Way: A way connected to the bus through a three-pole, group operated switch.
4. Tapped Way: A way solidly connected to the bus.
5. Breaker Protected Way: A way with breaker mechanism utilizing vacuum fault interrupting contacts to minimize fault interruption time.
6. Visible Disconnect: A disconnection device that provides a visible open for vacuum switching used as a double check for safety.

2.3 GENERAL DESCRIPTION

A. Design:

1. The purpose of the Loop-Tap Switch assembly is to provide a link in the loop feeder system that will also provide a tap to feed each crane or unitized transformer. The switches can isolate the tap from either of the two sections of the loop or can connect the two sections together to complete the loop through the assembly. This arrangement allows the loop, normally operated with one open switch, to continue in service while segregating a faulted section of the loop without causing an interruption to any crane or substation. The normally open switch would generally be located at the electrical load center of the loop, the source ends of which are connected to two separate bus sections at the Substation.

Through operation of selected loop switches, further reliability is provided by allowing the entire loop to operate from one of the Substation busses in case of an interruption of service on one of the Terminal’s incoming feeders.
2. The Circuit Breaker Tap is a standard vacuum switch described below that is equipped with additional equipment to allow tripping through overload or ground fault conditions as well as providing certain monitoring and metering functions. All equipment is provided within the Loop-Tap Switch enclosure or within a separately attached enclosure. The equipment is stand-alone in that no outside control power or circuits are required for its normal operation.

3. Within the switches, load interruption arcing shall take place in a vacuum to keep system switching transients to a minimum.

4. Fault clearing shall take place in a vacuum to minimize clearing time. Max 3.5 cycles.

5. Nominal Voltage of all switches shall be 15 kV.

6. Basic Insulation Level (BIL) of all switches shall be 95 kV.

7. One Minute Withstand (60 Hz) of all switches shall be 35 kV.

8. Continuous Current (Maximum in Amps) of all switches shall be 600 amps.

9. Load switching of all switches shall be 600 amps.

10. Number of mechanical operations of load interrupting mechanism of all switches is 6,000.

11. Maximum 3-time Interrupting Capacity of load break mechanism in Symmetrical Amps is 16,000.


13. Momentary & Make & Latch (Asymmetrical Amps) 25,100

14. Switch design shall not include fuse that requires oil drained to access fuse.

B. Way Electrical Design:

1. 2 ways switched terminating with 600 amp bushings/ (wells).

2. 1 way vacuum breaker protected terminating with 600 Amp bushings/ (wells).

3. Other Ways as indicated on drawings.

C. Protective Relay Design: The switchgear shall include microprocessor-based relay control protection including overcurrent protection, monitoring, oscillography, event recording, communication, and state of the art programmability. The relay front operating panel shall be intuitively designed to minimize training costs and avoid potential misoperation. The front panel will include front panel pushbuttons and targets, front panel programmability of all relay settings, programmable LCD text messages, quick metering access, indication LED’s, and quick alarm identification. Control parameters shall also be programmed via a personal computer connected to the control through a front panel RS-232 port. The relay control shall use internally mounted 1000:1 split-core bushing current transformers to sense the line currents. Power for relay operation shall be supplied either by a potential transformer internal to the switchgear or by customer supplied power. PT ratios within the relay will be selectable. The control shall have a minimum operating temperature range of -40°C to +65°C with no more than a ±5% variation in time-current response characteristics from its response at +25°C. The relay control shall provide inverse time and definite time overcurrent protection for both phase and ground that is field selectable either from the front panel of the relay or through a PC interface. All inverse time elements shall have selectable TCC curves. The TCC choices shall include IEEE inverse, very inverse, and extremely inverse and IEC A, B, and C curves.

The relay control shall provide instantaneous and/or demand metering with programmable integration intervals for the following functions: Demand currents on a per phase basis, instantaneous currents, including ground current, instantaneous frequency, and harmonics on a per phase basis. Oscillography shall be provided to present current
waveforms as a diagnostic tool. The user shall have the capability to move through the oscillographic event and watch the instantaneous values. The control shall have the capability of modifying the control settings and watching the affect of the change in settings on a previously stored event. The oscillographic sampling rate shall be a minimum of 16 samples per cycle. Event size shall be user selectable from 2 to 30 cycles with the capability of recording a minimum of 20 events for a 12-cycle event. Application software provided with the relay control shall include additional functions used to create and graphically display a workbench for creating custom functions, configuring user-selectable inputs and outputs, configurable event and alarm data, configurable sequence of events, oscillographic triggers, and selectable communication points. The application software shall allow the user to program the control using simple graphical logic characters, internal alarms, statuses, and targets. The user shall have the ability to perform logical functions with a combination of these variables using drag and drop functionality supported by the control. The software shall provide a true graphical programming environment. Logical equation programming shall not be acceptable. The relay control shall provide both discrete and serial communications with a minimum of ModBus and DNP3 serial communications protocol options supported. Upgrading of communications to Ethernet fiber optic shall be possible on the basic control provisions. The control shall be capable of exchanging analog and digital data between neighboring devices for optimal operation of the distribution system, and the information that is exchanged shall be programmable. The relay control shall have a customer-programmable security code to limit access of control programming and viewing functions to authorized personnel. There shall be a connection password when communicating between the control and a personal computer. The control shall be housed in a weatherproof outdoor cabinet with accessible through dual-entry (front and rear) doors. Each door shall include gasketing to assure a watertight seal and include locking provisions for utility grade locks. A minimum of two latch points shall be required for each door.

1. The Contractor shall ensure that the Relay Manufacturer coordinates with the Crane and Transformer Manufacturer to guarantee trouble-free operation of all relay protection, monitoring and metering functions in conjunction with the anticipated solid-state crane drive equipment and the harmonic current and voltage content generated there from.

2. The Contractor shall ensure that the Loop-Tap Switch manufacturer coordinates with the Relay manufacturer to assure proper mounting and operation of all controlled equipment to satisfy the requirements of the project. Of particular importance is that the Loop-Tap Switch energy storage equipment provides sufficient power to operate the relay and trip the circuit breaker during fault conditions.

3. The Contractor shall provide all software and documentation necessary for the installation, operation, maintenance, and troubleshooting functions of the digital relay.

4. The Contractor shall provide the services of a qualified, factory-trained manufacturer’s representative to provide technical support and startup of the specified relay, monitoring, and metering equipment. The representative shall also provide a training session at the construction site as stipulated under “Training” at the end of this Section.

5. Multipurpose device is to match similar device provided in Phase 1A work: (Cooper Model IDP210).
D. Ground Check Monitor Design (Crane Loop Switches Only): The ground check monitor shall be provided to:

1. Detect open ground-check conductor throughout the crane’s 15 kV electrical system.
2. Detect open ground return.
3. Detect ground-check conductor short-circuiting to ground.
4. The ground check monitor shall include a Zener-diode termination for reliable ground-check verification. The monitor shall not require a ground-check loop-resistance calibration.
5. The device shall include an LED Indication of ground-check Trip, Valid, Open, and Short as well as a power “on” LED. A minimum of eleven ground-fault setpoints shall be provided.
6. The power supply shall be coordinated with the available range of ac and dc voltages.
7. For operation with the container cranes, a DFT (harmonic filter) shall be provided to prevent nuisance tripping.
8. Ground-check functions shall fail-safe and shall include current-sensor (CS) verification and indication.
9. The ground check circuit shall utilize a non-hazardous voltage and have a wide ground-fault set-point range.
10. The Contractor shall provide all software and documentation necessary for the installation, operation, maintenance, and troubleshooting functions of the digital relay.
11. The ground check device shall be as manufactured by Startco Engineering Ltd., Saskatoon, Canada, their Model SE-134C with an SE-CS10 current sensor and an SE-TA6A termination device or approved substitution.
12. Provide quantity of ground check monitoring devices as required for number of parallel feeder circuits as shown on plans. Allow space inside enclosures for devices.

E. Fault Direction Indicator Design - General Specification:

1. The fault indicator is selected to facilitate location of faulted sections of loop circuits to avoid lengthy field tests and trial and error detection methods. The device shall be expressly designed to be installed on leading manufacturer’s loadbreak elbows with the separable connectors rated for 600A with a voltage test point. The device shall include a stored energy design that utilizes the capacitively coupled voltage present at the elbow test point to operate a “fault” flag in a remote display window attached to the exterior of the loop tap switch enclosure. When the system is re-energized, the indicator shall reset automatically.
2. The fault indicator shall incorporate an inrush restraint feature of 200 ms to ignore current spikes and inrush currents caused by switching transients.
3. A low pass filter shall be provided to prevent the indicator from tripping on high frequency transients.
4. Provide all components including the remote display with remote cord, necessary attachments and mounting means for the indicator and its display unit.
5. Provide one (1) set of three (3) indicators for each set of parallel feeder conductors at the loop tap switches indicated, one for each phase conductor of each parallel feeder set.
6. Fault Indicator to be as manufactured by Cooper Power Systems, their Model S.T.A.R, Type TPR S320-40, or an approved substitution.

F. CT’s and PT’s:

1. Current and Potential Transformers shall be selected by the Instrument or Device Manufacturer for operation over the optimum range of current or voltage measured.

2. Accuracy of CT’s and PT’s shall be plus/minus 1 percent over entire range. CT and PT devices shall be manufactured according to the standards of ANSI/IEEE C57.13, CSA CAN3-C13 and IEC 185.

2.4 CONSTRUCTION REQUIREMENTS

A. Electrical: Load Break Switch: The switch shall utilize vacuum interrupters having load and fault break capabilities and shall meet or exceed the number of operations required by applicable requirements of IEEE Std. C37.60 & C37.74.

1. Vacuum loop switch assembly enclosure size shall conform to the mounting pad and conduit entry layout shown on plans in order to assure switch assembly fits designated space.

2. Circuit Breaker: The circuit breaker shall utilize vacuum interrupters and be rated to carry 600 amps continuously, break 600 amps load and interrupt fault current of 16,000 amps symmetrical within 2½ cycles after energization of the trip coil.

B. A stainless steel ground pad shall be provided that is welded to the switchgear tank and mounted beneath each bushing, in each compartment.

C. Manual Operating Provisions:

1. Manual operating handles shall move in to close and out to open. The direction of operation shall be from bottom to top.

2. Manual operating handles shall be located where they can be operated either to open or to closed positions with standard live-line tools. The force required to operate the handle shall be such that one person in a standing position can readily operate it.

3. The switch mechanism shall be designed so that operation does not require any special skills, and the closing and opening speeds of the contacts are independent of the speed at which the operating handle is operated.

4. Manual operating handles shall be capable of being padlocked in the open position.

5. Provisions shall be made to install a Kirk Key Interlock device on the tap circuit breaker to be furnished by others but installed by the Contractor. The device will be designed to prohibit closing of the circuit breaker after the interlocking key has been withdrawn. The Contractor will be given the details as well as a sample of the device by the Port of Houston Authority to allow the proper mounting means to be designed by the manufacturer of the loop tap switch to be installed in the field. The companion interlock will be furnished and installed on the associated crane by others.

6. In addition to the above, provide a Kirk Key interlock on each loop switch assembly (two per assembly), keyed to interlock with the two Main Substation Loop Feeder Circuit Breakers. The interlock shall be arranged to prevent the
closure of all switches within a loop, which would constitute a closed loop connection capable of back feeding into one of the two loop circuit breakers, which may be open and assumed safe at the Main Substation. The only circumstance where a full loop connection is to be allowed is when one or the other of the loop circuit breakers is electrically open but the physical door Kirk Key locked closed to prevent entry and access to the live bus and contacts.

D. Load Break Switch Operating Mechanism: Switches shall utilize vacuum interruption only. Switches shall be three-phase gang-operated vacuum switches that meet or exceed the performance requirements of ANSI C37.72. The mechanism and the vacuum interrupters employed shall be capable of interrupting the rated continuous current and fault currents up to 16-kA symmetrical. The switch shall have a single operating handle, designed for operation with a lineman's hotstick that has a push to close / pull to open operation requiring no more than 75 lbs. of force at the handle and 60 degrees of movement for complete operation. Switch operating handles shall be front plate mounted and shall be padlockable in both the open and closed positions. Mounting provisions for Kirk key interlocks shall be provided as a standard feature. If specified, an operations counter shall be supplied that is externally mounted on the frontplate of the switchgear and mechanically linked to the operating handle circuit breaker mechanism.

E. Circuit Breaker Mechanism: The switchgear shall incorporate a vacuum fault interrupter for tap overcurrent protection. The device shall interrupt all fault currents up to the rated maximum. The interrupter shall be manually resettable, with no consumable parts (i.e. fuses). The maximum interrupting time from issuance of a trip signal from the electronic control shall be 2 cycles. To provide maximum safety to the operator, the interrupter shall incorporate a trip-free mechanism to prevent the possibility of holding the interrupter closed under a faulted condition. When three-phase trip operation is specified, the vacuum fault interrupter shall act as a three-phase group operated circuit breaker. The trip mechanisms for each phase shall be mechanically linked and the electronic control shall be set so that an overcurrent condition on any one phase shall simultaneously trip all three phases. A single operating handle shall be provided for manual opening, reset and closing. The operating handle shall be mounted on the frontplate of the tank in the tap compartment and shall have three distinct operating positions corresponding to whether the vacuum fault interrupter is open, closed, or tripped. A pointer attached to the handle along with a decal shall be provided for ready identification of the handle position. The handle shall be designed for operation with a lineman’s hotstick and have a push to close / pull to open / pull to reset operation requiring no more than 75 lbs. of force at the handle and 60 degrees of movement for complete operation. When the vacuum fault interrupter is tripped, the operating handle shall drop to an intermediate position between its closed and open positions, to indicate that it is tripped. The operating handle assembly shall include provisions to padlock the handle in the Open position.

F. Visible Break: A visible break switch to provide a visible gap in the circuit shall be provided. This shall be available on the load protecting VFI interrupters. The visible break switch shall be a two position (Open/Closed). The visible break option will consist of an isolating switch, in series with the vacuum switch, which meets all of the current and voltage ratings of the switchgear. The contacts of the visible break switch will be clearly visible through a 4” x 11” view window manufactured of a clear material with an impact strength rating of “Excellent.”

Both the vacuum switches and their corresponding visible break switches shall be mechanically interlocked such that the visible break switch will never operate under load. Despite the interlock preventing the operation of the visible break under load, the visible break switch shall be fully capable of switching the full current and voltage ratings of the
switchgear and shall meet the make/latch and momentary ratings as well. The visible break switch shall be operated from the side of the switchgear via a rotary style hot stick operable handle.

G. Auxiliary Switches: When specified, the source vacuum switches shall be provided with two “a” and two “b” auxiliary switches for the purpose of remote indication of switch status or other customer use. The auxiliary switches shall be linked to the movable contact rod of the vacuum switch and shall be internally pre-wired to a MIL C-5015 style circular power connector receptacle that is mounted on the source frontplate. The receptacle shall be provided with a mating plug for customer installation and termination of their cable. The auxiliary switches shall be rated for 15-amps @ 120-VAC / 1-amp @ 125-VDC.

H. Semaphores: Open/Closed semaphore shall be provided which shall serve the purpose of giving a second confirming indication of the open or closed state of the source vacuum switches and/or the tap vacuum fault interrupters. The semaphore shall be mounted internally and shall be directly linked to the movable contact rod of the vacuum switch and/or vacuum fault interrupter. The semaphore shall be visible through a viewing window on the tank frontplate near to the operating handle for the vacuum fault interrupter.

I. Position Indicators:
   1. Switches shall be provided with position indicators or other suitable means that clearly and positively indicate the open and closed positions of the contacts.
   2. The indicators shall be visible with the enclosure open.

J. Insulating Medium Quantity Indicators:
   1. Procedures or devices that require exposing the insulating medium to the outside environment are not permitted.
   2. Provision shall be made for personnel to readily determine safe insulating liquid level with the switch energized.
   3. Both the source- and tap-side of the switchgear shall have an oil level indicator sight glass.

K. Sampling and Additional Provisions:
   1. Provisions shall be made to facilitate replacement of the insulating medium with the padmounted switchgear de-energized.
   2. Provisions shall be made for adding the insulating medium to the tank with the switch energized.
   3. Oil insulated units shall be equipped with a 1-inch oil-fill plug and a 1-inch drain plug with sampler. A single Qualitrol #202-020-08N automatic pressure relief valve shall be supplied that is hotstick operable and located on the source side frontplate above the oil level within the switchgear.

L. Access Door and Tank Construction:
   1. The tank shall be constructed of 10 gage AISI 304L stainless steel. The cabinet and doors shall be constructed of 12 gage AISI 304L stainless steel.
   2. Oil insulated units shall have a tamperproof bolted tank cover design, utilizing Buna-N rubber gaskets. The sealed tank (when deadfront terminators are installed) shall be capable of withstanding flood immersion while energized, and
shall not allow the ingress of any airborne contaminants. The main and tap cable compartments shall be located at the front and back of the tank respectively. The main compartment shall house source bushings and source switch operating handles. The tap compartment shall house tap bushings and the VFI operating handles. The operating handles for optional visible break switches shall be located at the sides of the switchgear tank inside padlocked “side-pockets.” These "side pockets" shall be bolted shut using pentahead bolts and shall house T-Handles for operation of the rotary style visible break switch handles. Recessed lifting provisions for suitable balanced lift shall be provided.

3. Side-hinged cabinet style doors shall be provided. The side-hinged doors shall provide three-point latching and shall not require a center support post. Side-hinged doors shall have a door stay to manually latch the door in the open position at approximately 120º from the closed position. For all door designs, the right hand door on each side shall be the first opening door. The doors shall be secured with recessed pentahead bolts, with provisions for padlocking. Door hinges shall be provided with stainless steel hinge pins. Units wider than 46 inches shall have split doors to allow easy operation by one person. Each door shall have a floating lock pocket with padlock hasp and pentahead stainless steel door bolt. Cabinet construction shall meet all NEMA and ANSI security requirements as defined in the ANSI C57.12.28 standard and the construction requirements of the ANSI C37.72 standard.

4. All hinged doors shall be equipped with a positive latching device to prevent unintentional closing.

5. Bushings shall be deadfront type for use with separable connectors conforming to ANSI/IEEE Standard 386 and ANSI Standard C119.2. The bushings shall have a continuous current rating of 600-amps as specified in the one-line diagram for the switchgear configuration required. Bushings must be horizontally mounted at least 24 inches above the pad and accept molded, separable deadfront connectors. Bushings shall be mounted with minimum spacings of 10.0-inches between centerlines, except between the C-phase bushings, which may be a minimum of 7.0-inches on configurations with six or more bushings mounted on a frontplate. A standoff bracket or parking stand shall be supplied for each bushing and shall be mounted horizontally adjacent to each bushing on a 5.0-inch centerline from the bushing centerline. No parking stands shall be mounted between the C-phase bushings. The standard phasing of the bushings from left to right shall follow the sequence ABC-CBA. Each bushing shall have an identification decal affixed to the frontplate identifying its source or tap designation, as shown on the one-line operating diagram, and its phase identification. 600-amp bushings shall be RTE insulated deadbreak type conforming to ANSI/IEEE Std. 386 and ANSI C119.2 with aluminum current carrying parts. The bushings shall be provided without removable studs unless otherwise specified. 600-amp taps shall be furnished with Cooper 600-amp deadbreak bushing wells with removable studs, Bushing wells shall conform to ANSI/IEEE Std. 386 and ANSI C119.2 and accept bushing inserts conforming to these standards. Bushings shall be externally replaceable and shall not require removal of the tank cover to remove or install replacement bushings.

6. No external portion of the tank or accessories shall trap water.

7. Lifting lugs shall be welded to the tank so that the switch will remain level when being lifted. The lugs shall be designed and located to avoid interference between lifting slings and any attachments.

8. Parking stands located such that any elbow can be easily parked with a minimum distance of travel, and elbows from one way can be all parked.

N. Bushing Designation: The switch bushings shall be identified and legibly marked adjacent to each bushing with the appropriate phase designation, using a nameplate of corrosion resistant material.

O. Tank Nameplate: A non-corrosive operating diagram (one-line schematic) shall be affixed to the inside of the door, on both sides of the unit. When visible break switches are specified, the one-line schematic will also show the electrical connection of these switches. A single nameplate shall be provided that is mounted on the source side tank frontplate in the upper right hand corner. The switching current and voltage ratings on this nameplate shall also apply to the visible break switch. For mild steel construction, these items shall be made of aluminum. When stainless steel construction is required, these items shall be made of stainless steel. The nameplate shall contain the following information:

1. Catalog number
2. Model number
3. Serial number
4. Nominal voltage class, kV
5. Rated maximum voltage, kV
6. Rated continuous current, A
7. Rated load interrupting rating, A
8. Momentary current rating, kA asym.
9. Make & latch rating, kA asym.
10. Total weight, lbs.
11. Oil volume (gals.) or SF6 pressure (lbs/in² gauge)

P. Enclosure Nameplates: Provide nameplates as described above mounted on exterior of enclosure with the words, “Crane No. X” with the actual crane number substituted for the letter “X”. Identical nameplates shall similarly be provided for substation identification.

Q. Factory Testing Requirements: The unit shall be subjected to the following production tests:

1. Continuity test to assure correct internal connections.
2. Hi-pot test to determine dielectric strength of the unit.
3. Pressure test to assure tank is completely sealed.
4. Electrical TCC trip test.

R. Shipping Requirements:

1. Preparation:
   a. The switch shall be completely assembled and include all appurtenances and the required insulating medium.
   b. Switches shall be properly packaged and braced to prevent damage during shipment.

2. Documentation: Instructions, documentation and checklists for the inspection, installation, and maintenance of the switch and all appurtenances, including software, shall be provided.
Additional Requirements: Coordinate enclosure size and construction to accommodate additional potential or current transformers associated with automatic power factor correction units where required. See Section 26 09 13.00 – “Automatic Power Factor Correction” for additional requirements. Coordinate bus bar or conductor installation with any required current transformers or potential transformers.

T. Provide all terminals sized to accommodate wire sizes and quantities.

PART 3 EXECUTION

3.1 PREPARATION

A. General:

1. Each crane shall be identified and each Assembly shall be clearly labeled with the identification of actual crane served. Furnish the Loop-Tap Switch Assembly manufacturer the actual nameplate data from each crane served by the Assembly.

2. Furnish the Loop-Tap Switch Assembly manufacturer the details and sample of the Kirk Key Interlock device to be installed on each circuit breaker. The sample is not to be installed but only used as a model for the mounting means. Kirk Key Interlocking devices on the Tap Switch shall be installed only Assemblies Serving Cranes. All Loop Switch Assemblies shall have Kirk Key Interlocks to prevent an unsafe condition at the Substation as described above.

B. Examination: Verify that the electrical installation, structural, and related Work performed under other Sections of the Specifications, satisfy the requirements for the performance of the Work in accordance with the Contract Drawings in this Section and as specified in this Section.

C. Field Supervision:

1. Provide the services of a qualified, factory-trained Loop-Tap Switch Assembly manufacturer's representative to provide technical field support in the installation and start-up of the equipment specified in this Section. The manufacturer's representative shall provide technical direction and assistance in the following:

   a. Direct the Switchgear Assembly.
   b. Perform Required Equipment Adjustments
   c. Equipment Checkout and Calibration, including all protective relay, monitoring and metering functions
   d. Troubleshooting.

3.2 INSTALLATION

A. Switchgear shall be transported within the construction site, unloaded, uncrated, handled, stored, installed, including assembly of all component parts, and wired in accordance with the manufacturer's recommendations, applicable ANSI standards, and the requirements specified in this Section.
B. Provide all equipment, supervision, labor, rigging, tools, including, but not limited to, special equipment such as cranes.

C. Before setting the switchgear, the concrete pad and openings for conduits cables shall be checked for accuracy of position.

D. Switchgear shall be set on foundations at the locations shown on the Contract Drawings. Provide floor sills, and set level on a concrete pad with an elevation of approximately 2-inches above the foundation. Follow the manufacturer's recommendations for preparation of the mounting surface and the fastening of the equipment. The switchgear shall be set, adjusted, and leveled in place, using shims where necessary. Allow an air space of approximately 6-inches between enclosures to avoid the collection of debris and to allow cleaning.

E. The Contractor shall obtain from the manufacturer written Certificates that the switches, circuit breakers, and protective/monitoring/metering devices have been properly installed and adjusted and that the proper overloads have been installed. Prior to start up of equipment, submit the manufacturer's certification to the Port Construction Representative for approval.

F. Cables shall be neatly racked and bundled with nonflammable nylon ties, routed into the enclosure compartment. Minimum bending radii as recommended by cable manufacturers shall not be reduced. Install test point type elbow connectors as recommended by the assembly manufacture to match the bushing provided.

G. Bushings and grounding connections shall be cleaned and insulated by the insulating boots on the connectors. Make all grounding connections to the equipment as recommended by the manufacturer and as shown on the drawings.

H. Covers or enclosures of individual equipment items shall all be securely bolted in place.

I. Install, wire, and connect the Ground Check Relay in accordance with the Contract Drawings and manufacturer's drawings and instructions. The companion connections on the crane and the installation of the circuit terminating Zener Diode will be by others.

J. All damaged paint areas shall be properly prepared by the Contractor for an application of primer and finish coats of paint, which shall be supplied by the manufacturer for this purpose. The Contractor shall apply the primer and finish paint coats.

K. After each item of equipment is installed and connected, the Contractor shall make a thorough inspection of the installation, cleaning all bushings and connectors and cleaning all compartments of debris and foreign matter. Prior to final acceptance of the Work, and field testing, the Contractor shall clean the equipment of all construction dust and dirt. A careful check shall be made to ensure that all members included for shipping purposes have been removed.

3.3 FIELD TESTS

A. Field tests and inspection for commissioning the Loop-Tap Switch Assembly shall be performed in accordance with only applicable portions of Section 26 08 00.00 - Field Testing and Section 26 08 00.01 – “Medium Voltage System Commissioning Tests” of these Specifications. Those tests performed by the equipment manufacturer in the field need not be repeated to comply with this specification section. Advise the Port Construction Representative, in writing, upon failure of any equipment or material to pass.
the tests performed, or to function properly as intended. In the event that testing does not meet the requirement for proof of satisfactory performance specified herein, the Contractor shall repeat the test. The Port Construction Representative reserves the right to decide whether a test must be repeated. Devices failing the repeated tests and deemed un-repairable by the Port Construction Representative, shall remain the property of the Contractor.

3.4 TRAINING

A. Provide training sessions at the construction site for the number of Authority personnel, for two (2) eight (8) hour days or as required by the Port Construction Representative.

B. The training sessions shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, major components and the protective relaying, monitoring and metering equipment within the assembly, including all software and associated documentation.

C. The training program shall consist of instructions for start-up, testing, operating, and troubleshooting of the specified equipment as well as the means and requirements for remote communications. Full documentation and software shall be introduced and provided at the sessions as follows:

1. Training Manual
2. Standard Manual for Operation and Maintenance, Testing and Troubleshooting
3. Software with Documentation for training, operation and maintenance, and troubleshooting
4. Full documentation for Remote Communication to permit Monitoring, Data Retrieval, changing Setpoints, and executing Commands for future use by the Port of Houston Authority
5. Parts List and Recommended Spare Parts

3.5 ARC FLASH HAZARD ANALYSIS – (NOT APPLICABLE)

3.6 SIGNAGE AND WARNING LABELS

A. Verify all NEC required safety signage has been installed, including high voltage and arc flash warning labels, per NEC Article 100. Reference Section 26 60 02.00 – “Protective Device Coordination,” Paragraph 2.4 entitled “Arc Flash Warning Labels” for additional requirements.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 13 19.00 Add – VACUUM LOOP SWITCH ASSEMBLY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specification for three-phase, group operated, 60 Hz, padmount, load and fault interrupting vacuum switch assembly, Envirotemp FR3 fluid insulated, with maximum ratings of 600 A and 15.5 kV, and utilizing separable insulated connectors. The assembly, hereinafter designated as a “Loop-Tap Switch,” shall contain fault-indicating equipment as specified.

1.2 REFERENCES


B. Institute of Electrical and Electronics Engineers (IEEE):

1. 386-1995 IEEE Standard for separable insulated connector system for power distribution systems above 600 volts.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following details are required.

1. Overall dimensions.
2. Shipping packaging.
3. Identification of units.
4. Unit locations.
5. Locations of incoming and outgoing line bushings.
7. Available conduit entrance areas.
8. Bushings and Bushing Stands; Phase and Ground.
C. Schematic and elementary diagrams for individual unit, and master terminal boards consisting of drawings, which identify:

1. Electrical devices.
2. Electrical connections.
3. Terminal numbering designations.
4. Name plate data and complete electrical ratings.

D. Documentation for the installation, operation, and maintenance of solid state protective relaying, monitoring and metering equipment that clearly demonstrate the equipment’s ability to function as intended in this project.

E. Catalog Cuts:

1. Vacuum switches.
2. Nameplates.
3. Connection bushings and test point connectors.
4. Other factory or field mounted devices shown on the Contract Drawings or as required for operation of equipment.

F. Manufacturer's certifications.

G. At time of acceptance of the Loop-Tap Switch Assembly, deliver all copies of all software with associated documentation for the installation, operation, maintenance and troubleshooting for all of the digital equipment installed.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workmen. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Loop tap switch assemblies shall be delivered with all electrical devices, including but not limited to circuit breakers, switches, relays, fault indicators and control power transformers shall be in place and wired. Packaging materials shall be arranged to prevent damage to components due to vibration, jarring, and the like during transportation and handling.

B. Electrical devices shipped loose shall be delivered in the manufacturer's original unopened protective packaging and shall be identified with suitable, non-corrosive tags.

C. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of the final cleaning up.

D. Touch up any damage to finishes to match adjacent surfaces.
1.6 MEASUREMENT AND PAYMENT

A. No separate payment for this item. Payment for “Vacuum Loop Switch Assembly” shall be part of the lump sum payment for the complete unitized substation of BSS-4 in accordance with Specification 26 11 16.00.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Trayer Engineering Corp.

B. Cooper Power Systems.

C. Or pre-approved (in writing) substitution.

2.2 DEFINITIONS

A. The definitions of terms contained in this specification, or in other standards referred to in this document, are not intended to embrace all the legitimate meanings of the terms. They are applicable only to the subject treated in this specification.

1. Bus (as used in this specification): A three-phase junction common to two or more ways.

2. Way: A three-phase circuit entrance to a switching assembly.

3. Switched Way: A way connected to the bus through a three-pole, group operated switch.

4. Tapped Way: A way solidly connected to the bus.

2.3 GENERAL DESCRIPTION

A. Design:

1. The purpose of the Loop-Tap Switch assembly is to provide a link in the loop feeder system that will also provide a tap to feed each crane feeder. The switches can isolate the tap from either of the two sections of the loop or can connect the two sections together to complete the loop through the assembly. This arrangement allows the loop, normally operated with one open switch, to continue in service while segregating a faulted section of the loop without causing an interruption to any crane or substation. The normally open switch would generally be located at the electrical load center of the loop, the source ends of which are connected to two separate bus sections at the Substation. Through operation of selected loop switches, further reliability is provided by allowing the entire loop to operate from one of the Substation busses in case of an interruption of service on one of the Terminal’s incoming feeders.

2. All equipment is provided within the Loop-Tap Switch enclosure or within a separately attached enclosure. The equipment is stand-alone in that no outside control power or circuits are required for its normal operation.

3. Within the switches, load interruption arcing shall take place in a vacuum to keep system switching transients to a minimum.
4. Fault clearing shall take place in a vacuum to minimize clearing time. Max 3.5 cycles.
5. Nominal Voltage of all switches shall be 15 kV.
6. Basic Insulation Level (BIL) of all switches shall be 95 kV.
7. One Minute Withstand (60 Hz) of all switches shall be 35 kV.
8. Continuous Current (Maximum in Amps) of all switches shall be 600 amps.
9. Load switching of all switches shall be 600 amps.
10. Number of mechanical operations of load interrupting mechanism of all switches is 6,000.
11. Maximum 3-time Interrupting Capacity of load break mechanism in Symmetrical Amps is 16,000.
13. Momentary & Make & Latch (Asymmetrical Amps) 25,100
14. Switch design shall not include fuse that requires oil drained to access fuse.

B. Way Electrical Design:
1. 3 ways switched terminating with 600 amp bushings/ (wells).
2. Other Ways as indicated on drawings.

C. Fault Direction Indicator Design - General Specification:
1. The fault indicator is selected to facilitate location of faulted sections of loop circuits to avoid lengthy field tests and trial and error detection methods. The device shall be expressly designed to be installed on leading manufacturer’s loadbreak elbows with the separable connectors rated for 600A with a voltage test point. The device shall include a stored energy design that utilizes the capacitively coupled voltage present at the elbow test point to operate a “fault” flag in a remote display window attached to the exterior of the loop tap switch enclosure. When the system is re-energized, the indicator shall reset automatically.
2. The fault indicator shall incorporate an inrush restraint feature of 200 ms to ignore current spikes and inrush currents caused by switching transients.
3. A low pass filter shall be provided to prevent the indicator from tripping on high frequency transients.
4. Provide all components including the remote display with remote cord, necessary attachments and mounting means for the indicator and its display unit.
5. Provide one (1) set of three (3) indicators for each set of parallel feeder conductors at the loop tap switches indicated, one for each phase conductor of each parallel feeder set.
6. Fault Indicator to be as manufactured by Cooper Power Systems, their Model S.T.A.R, Type TPR S320-40, or an approved substitution.

D. CT’s and PT’s:
1. Current and Potential Transformers shall be selected by the Instrument or Device Manufacturer for operation over the optimum range of current or voltage measured.
2. Accuracy of CT’s and PT’s shall be plus/minus 1 percent over entire range. CT and PT devices shall be manufactured according to the standards of ANSI/IEEE C57.13, CSA CAN3-C13 and IEC 185.
2.4 CONSTRUCTION REQUIREMENTS

A. Electrical: Load Break Switch: The switch shall utilize vacuum interrupters having load and fault break capabilities and shall meet or exceed the number of operations required by applicable requirements of IEEE Std. C37.60 & C37.74.

1. Vacuum loop switch assembly enclosure size shall conform to the mounting pad and conduit entry layout shown on plans in order to assure switch assembly fits designated space.

B. A stainless steel ground pad shall be provided that is welded to the switchgear tank and mounted beneath each bushing, in each compartment.

C. Manual Operating Provisions:

1. Manual operating handles shall move in to close and out to open. The direction of operation shall be from bottom to top.

2. Manual operating handles shall be located where they can be operated either to open or to closed positions with standard live-line tools. The force required to operate the handle shall be such that one person in a standing position can readily operate it.

3. The switch mechanism shall be designed so that operation does not require any special skills, and the closing and opening speeds of the contacts are independent of the speed at which the operating handle is operated.

4. Manual operating handles shall be capable of being padlocked in the open position.

D. Load Break Switch Operating Mechanism: Switches shall utilize vacuum interruption only. Switches shall be three-phase gang-operated vacuum switches that meet or exceed the performance requirements of ANSI C37.72. The mechanism and the vacuum interrupters employed shall be capable of interrupting the rated continuous current and fault currents up to 16-kA symmetrical. The switch shall have a single operating handle, designed for operation with a lineman's hotstick that has a push to close / pull to open operation requiring no more than 75 lbs. of force at the handle and 60 degrees of movement for complete operation. Switch operating handles shall be front plate mounted and shall be padlockable in both the open and closed positions. Mounting provisions for Kirk key interlocks shall be provided as a standard feature. If specified, an operations counter shall be supplied that is externally mounted on the frontplate of the switchgear and mechanically linked to the operating handle circuit breaker mechanism.

E. (Omitted)

F. (Omitted)

G. Auxiliary Switches: When specified, the source vacuum switches shall be provided with two “a” and two “b” auxiliary switches for the purpose of remote indication of switch status or other customer use. The auxiliary switches shall be linked to the movable contact rod of the vacuum switch and shall be internally pre-wired to a MIL C-5015 style circular power connector receptacle that is mounted on the source frontplate.
The receptacle shall be provided with a mating plug for customer installation and termination of their cable. The auxiliary switches shall be rated for 15-amps @ 120-VAC / 1-amp @ 125-VDC.

H. Semaphores: Open/Closed semaphore shall be provided which shall serve the purpose of giving a second confirming indication of the open or closed state of the vacuum switches. The semaphore shall be mounted internally and shall be directly linked to the movable contact rod of the vacuum switch and/or vacuum fault interrupter. The semaphore shall be visible through a viewing window on the tank frontplate near to the operating handle for the vacuum fault interrupter.

I. Position Indicators:

1. Switches shall be provided with position indicators or other suitable means that clearly and positively indicate the open and closed positions of the contacts.
2. The indicators shall be visible with the enclosure open.

J. Insulating Medium Quantity Indicators:

1. Procedures or devices that require exposing the insulating medium to the outside environment are not permitted.
2. Provision shall be made for personnel to readily determine safe insulating liquid level with the switch energized.
3. Both the source- and tap-side of the switchgear shall have an oil level indicator sight glass.

K. Sampling and Additional Provisions:

1. Provisions shall be made to facilitate replacement of the insulating medium with the padmounted switchgear de-energized.
2. Provisions shall be made for adding the insulating medium to the tank with the switch energized.
3. Oil insulated units shall be equipped with a 1-inch oil-fill plug and a 1-inch drain plug with sampler. A single Qualitrol #202-020-08N automatic pressure relief valve shall be supplied that is hotstick operable and located on the source side frontplate above the oil level within the switchgear.

L. Access Door and Tank Construction:

1. The tank shall be constructed of 10 gage AISI 304L stainless steel. The cabinet and doors shall be constructed of 12 gage AISI 304L stainless steel.
2. Oil insulated units shall have a tamperproof bolted tank cover design, utilizing Buna-N rubber gaskets. The sealed tank (when deadfront terminators are installed) shall be capable of withstanding flood immersion while energized, and shall not allow the ingress of any airborne contaminants. The main and tap cable compartments shall be located at the front and back of the tank respectively. The main compartment shall house source bushings and source switch operating handles. The tap compartment shall house tap bushings and the VFI operating handles. The operating handles for optional visible break switches shall be located at the sides of the switchgear tank inside padlocked "side-pockets." These "side pockets" shall be bolted shut using pentahead bolts and shall house T-Handles for operation of the rotary style visible break switch handles.
Recessed lifting provisions for suitable balanced lift shall be provided.

3. Side-hinged cabinet style doors shall be provided. The side-hinged doors shall provide three-point latching and shall not require a center support post. Side-hinged doors shall have a door stop to manually latch the door in the open position at approximately 120° from the closed position. For all door designs, the right hand door on each side shall be the first opening door. The doors shall be secured with recessed pentahead bolts, with provisions for padlocking. Door hinges shall be provided with stainless steel hinge pins. Units wider than 46 inches shall have split doors to allow easy operation by one person. Each door shall have a floating lock pocket with padlock hasp and pentahead stainless steel door bolt. Cabinet construction shall meet all NEMA and ANSI security requirements as defined in the ANSI C57.12.28 standard and the construction requirements of the ANSI C37.72 standard.

4. All hinged doors shall be equipped with a positive latching device to prevent unintentional closing.

5. Bushings shall be deadfront type for use with separable connectors conforming to ANSI/IEEE Standard 386 and ANSI Standard C119.2. The bushings shall have a continuous current rating of 600-amps as specified in the one-line diagram for the switchgear configuration required. Bushings must be horizontally mounted at least 24 inches above the pad and accept molded, separable deadfront connectors. Bushings shall be mounted with minimum spacings of 10.0-inches between centerlines, except between the C-phase bushings, which may be a minimum of 7.0-inches on configurations with six or more bushings mounted on a frontplate. A standoff bracket or parking stand shall be supplied for each bushing and shall be mounted horizontally adjacent to each bushing on a 5.0-inch centerline from the bushing centerline. No parking stands shall be mounted between the C-phase bushings. The standard phasing of the bushings from left to right shall follow the sequence ABC-CBA. Each bushing shall have an identification decal affixed to the frontplate identifying its source or tap designation, as shown on the one-line operating diagram, and its phase identification. 600-amp bushings shall be RTE insulated deadbreak type conforming to ANSI/IEEE Std. 386 and ANSI C119.2 with aluminum current carrying parts. The bushings shall be provided without removable studs unless otherwise specified. 600-amp taps shall be furnished with Cooper 600-amp deadbreak bushing wells with removable studs, Bushing wells shall conform to ANSI/IEEE Std. 386 and ANSI C119.2 and accept bushing inserts conforming to these standards. Bushings shall be externally replaceable and shall not require removal of the tank cover to remove or install replacement bushings.

6. No external portion of the tank or accessories shall trap water.

7. Lifting lugs shall be welded to the tank so that the switch will remain level when being lifted. The lugs shall be designed and located to avoid interference between lifting slings and any attachments.

8. Parking stands located such that any elbow can be easily parked with a minimum distance of travel, and elbows from one way can be all parked.


N. Bushing Designation: The switch bushings shall be identified and legibly marked adjacent to each bushing with the appropriate phase designation, using a nameplate of corrosion resistant material.
O. Tank Nameplate: A non-corrosive operating diagram (one-line schematic) shall be affixed to the inside of the door, on both sides of the unit. A single nameplate shall be provided that is mounted on the source side tank frontplate in the upper right hand corner. For mild steel construction, these items shall be made of aluminum. When stainless steel construction is required, these items shall be made of stainless steel. The nameplate shall contain the following information:

1. Catalog number
2. Model number
3. Serial number
4. Nominal voltage class, kV
5. Rated maximum voltage, kV
6. Rated continuous current, A
7. Rated load interrupting rating, A
8. Momentary current rating, kA asym.
9. Make & latch rating, kA asym.
10. Total weight, lbs.
11. Oil volume (gals.) or SF6 pressure (lbs/in² gauge)

P. Enclosure Nameplates: Provide nameplates as described above mounted on exterior of enclosure with the words, "Crane Loop Tie Switch FT-X" with the actual crane loop tie switch number substituted for the letter “X.”

Q. Factory Testing Requirements: The unit shall be subjected to the following production tests:

1. Continuity test to assure correct internal connections.
2. Hi-pot test to determine dielectric strength of the unit.
3. Pressure test to assure tank is completely sealed.

R. Shipping Requirements:

1. Preparation:
   a. The switch shall be completely assembled and include all appurtenances and the required insulating medium.
   b. Switches shall be properly packaged and braced to prevent damage during shipment.
2. Documentation: Instructions, documentation and checklists for the inspection, installation, and maintenance of the switch and all appurtenances, including software, shall be provided.

S. (Omitted)

T. Provide all terminals sized to accommodate wire sizes and quantities.
PART 3 EXECUTION

3.1 PREPARATION

A. General:

1. Each switch shall be identified and shall be clearly labeled with the identification of actual crane loop tie switch.

B. Examination: Verify that the electrical installation, structural, and related Work performed under other Sections of the Specifications, satisfy the requirements for the performance of the Work in accordance with the Contract Drawings in this Section and as specified in this Section.

C. Field Supervision:

1. Provide the services of a qualified, factory-trained Loop-Tap Switch Assembly manufacturer's representative to provide technical field support in the installation and start-up of the equipment specified in this Section. The manufacturer's representative shall provide technical direction and assistance in the following:
   a. Direct the Switchgear Assembly.
   b. Perform Required Equipment Adjustments.
   c. Equipment Checkout and Calibration, including all protective relay, monitoring and metering functions.
   d. Troubleshooting.

2. The Contractor is responsible for notifying the Port Construction Representative as soon as he finds conditions which prevent the proper installation of materials or methods specified in this Section.

3.2 INSTALLATION

A. Switchgear shall be transported within the construction site, unloaded, uncrated, handled, stored, installed, including assembly of all component parts, and wired in accordance with the manufacturer's recommendations, applicable ANSI standards, and the requirements specified in this Section.

B. Provide all equipment, supervision, labor, rigging, tools, including, but not limited to, special equipment such as cranes.

C. Before setting the switchgear, the concrete pad and openings for conduits cables shall be checked for accuracy of position.

D. Switchgear shall be set on foundations at the locations shown on the Contract Drawings. Provide floor sills, and set level on a concrete pad with an elevation of approximately 2-inches above the foundation. Follow the manufacturer's recommendations for preparation of the mounting surface and the fastening of the equipment. The switchgear shall be set, adjusted, and leveled in place, using shims where necessary. Allow an air space of approximately 6-inches between enclosures to avoid the collection of debris and to allow cleaning.
E. The Contractor shall obtain from the manufacturer written Certificates that the switches have been properly installed and adjusted. Prior to start up of equipment, submit the manufacturer's certification to the Port Construction Representative for approval.

F. Cables shall be neatly racked and bundled with nonflammable nylon ties, routed into the enclosure compartment. Minimum bending radii as recommended by cable manufacturers shall not be reduced. Install test point type elbow connectors as recommended by the assembly manufacture to match the bushing provided.

G. Bushings and grounding connections shall be cleaned and insulated by the insulating boots on the connectors. Make all grounding connections to the equipment as recommended by the manufacturer and as shown on the drawings.

H. Covers or enclosures of individual equipment items shall all be securely bolted in place.

I. (Omitted)

J. All damaged paint areas shall be properly prepared by the Contractor for an application of primer and finish coats of paint, which shall be supplied by the manufacturer for this purpose. The Contractor shall apply the primer and finish paint coats.

K. After each item of equipment is installed and connected, the Contractor shall make a thorough inspection of the installation, cleaning all bushings and connectors and cleaning all compartments of debris and foreign matter. Prior to final acceptance of the Work, and field testing, the Contractor shall clean the equipment of all construction dust and dirt. A careful check shall be made to ensure that all members included for shipping purposes have been removed.

3.3 FIELD TESTS

A. Field tests and inspection for commissioning the Loop-Tap Switch Assembly shall be performed in accordance with only applicable portions of Section 26 08 00.00- Field Testing and Section 26 08 00.01 – “Medium Voltage System Commissioning Tests” of these Specifications. Those tests performed by the equipment manufacturer in the field need not be repeated to comply with this specification section. Advise the Port Construction Representative, in writing, upon failure of any equipment or material to pass the tests performed, or to function properly as intended. In the event that testing does not meet the requirement for proof of satisfactory performance specified herein, the Contractor shall repeat the test. The Port Construction Representative reserves the right to decide whether a test must be repeated. Devices failing the repeated tests and deemed un-repairable by the Port Construction Representative, shall remain the property of the Contractor.

3.4 TRAINING

A. Provide training sessions at the construction site for the number of Authority personnel, for two (2) eight (8) hour days or as required by the Port Construction Representative.
B. The training sessions shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, major components and the protective relaying, monitoring and metering equipment within the assembly, including all software and associated documentation.

C. The training program shall consist of instructions for start-up, testing, operating, and troubleshooting of the specified equipment as well as the means and requirements for remote communications. Full documentation and software shall be introduced and provided at the sessions as follows:

1. Training Manual
2. Standard Manual for Operation and Maintenance, Testing and Troubleshooting
3. Software with Documentation for training, operation and maintenance, and troubleshooting
4. Full documentation for Remote Communication to permit Monitoring, Data Retrieval, changing Setpoints, and executing Commands for future use by the Port of Houston Authority
5. Parts List and Recommended Spare Parts

3.5 ARC FLASH HAZARD ANALYSIS – (NOT APPLICABLE)

3.6 SIGNAGE AND WARNING LABELS

A. Verify all NEC required safety signage has been installed, including high voltage and arc flash warning labels, per NEC Article 100. Reference Section 26 60 02.00 – “Protective device Coordination,” Paragraph 2.4 entitled “Arc Flash Warning Labels” for additional requirements.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 13 20.00 Add – 15 kV LOAD BREAK CONNECTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for the following:
   1. 15 kV load break connectors.
   2. 15 kV load break elbows
   3. 15 kV load break bushing insert
   4. 15 kV load break accessories

1.2 REFERENCES

A. ANSI/IEEE Standards 386

1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following details are required.

    1. Overall dimensions.
    2. Shipping packaging.
    3. Identification of units.
    4. Unit locations.
    5. Locations of incoming and outgoing line bushings.
    7. Available conduit entrance areas.
    8. Bushings and Bushing Stands; Phase and Ground.

1.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.
PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cooper Power Systems
B. Pre-approved (in writing) equal

2.2 MATERIALS AND EQUIPMENT

A. Load break connectors, bushing elbows, bushing inserts and deadbreak junctions shall provide the following:
   1. 10,000 ampere fault-closing capability
   2. Piston-operated fault-close action
   3. Standard elbow and bushing insert loadbreak principle
   4. Ease of hot-stick handling
   5. Field replaceable elbow and probe
   6. Molded shields
   7. Peroxide-cured EPDM compounds
   8. Full compliance with ANSI/IEEE Standard 386
   9. Can be used with cables having a metallic tape shield, wire shield, or lead sheath with tape or extruded insulation shielding.
10. All insulating and conducting rubber components made of special formulation of EPDM elastomer by a peroxide curing process.
11. Long-time operation in either aboveground or subsurface installations.
12. Elbow connector/bushing insert combinations suitable for energized loadmake/loadbreak operations use of shotgun type hot stick by a qualified lineman.
13. Elbow/bushing insert combinations designed for use with subsurface (submersible to 10 feet of water) or pad-mounted installations.

B. 15 kV Loadbreak Product Ratings:
   1. Maximum Continuous Voltage:
      a. 8.3 kV phase-to-ground
      b. 14.4 kV phase-to-phase
   2. Continuous Current: 600-ampere rms.
   3. 8 Hour Overload: 300-ampere rms.

C. Short-Time Current Ratings:
   1. 0.17 Second Duration: 16,000 amperes rms symmetrical.
   2. 3.00 Second Duration: 3500 amperes rms symmetrical.

D. Insulation Withstand Voltages:
   1. Basic Impulse Level (1.2 x 50 Microseconds Wave): 95 kV crest.
   2. 60 Hertz (one minute): 34 kV rms.
   3. DC (15 minutes): 53 kV.
   4. Corona Extinction Voltage (3 picocoulombs): 11 kV.

E. Switching: Single phase and 3 phase circuits 8.3 kV phase-to-ground, 14.4 kV maximum across the open contacts: 10,000 loadmake/loadbreak operations at 200 amperes with 90 percent parallel and 10 percent series resistance reactance load at 0.8 power factor.
F. Fault Closure: One fault-close operation at 8.3 kV phase-to-ground, or 14.4 kV phase-to-phase; 10,000 amperes rms symmetrical, 10 cycles, (0.17 seconds).

G. Products to include:
   1. Loadbreak elbow connector; Cooper Power System 500-10.

PART 3 EXECUTION

3.1 GENERAL

A. Complete cable, underground duct banks, and cable support systems before installing loadbreak connectors on cables.

B. Verify cable arrangement in manholes to ensure proper accommodation for the cable connectors.

3.2 INSTALLATION

A. Cable Connectors:

   1. Clean cables of all foreign matter before cable connectors are installed.
   2. Install connectors in accordance with the manufacturer’s instructions and the National Electrical Code (NEC).

B. Tests:

   1. Before connecting the medium voltage cables, test insulation integrity.
   2. Contractor shall employ an electrical testing company as required in Section 26 08 00.01 – “Medium Voltage System Commissioning Tests” to perform Megger and Hi Potential test on newly installed cables.
   3. Use a 5 kV DC megohmmeter and perform the cable insulation test in accordance with the operating instructions.
   4. Record test data for each cable test and report meggering test complete with signatures of the Port Construction Representative or designated representative who witnesses the testing.
   5. If a cable fails tests, the fault shall be located using time domain reflectometry measuring instrument, and all cables in that conduit between the nearest pulling points on each side of the failure shall be withdrawn. If, in the opinion of the Chief Engineer or the Port of Houston Authority, the other cables in the same conduit have not been damaged, they may be reinstated, but the cable, which failed, shall be replaced by new cable. After the replacement of the faulted cable, and any other damaged cables, all cables of the circuit in that conduit shall be retested.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 22 00.00 Add – TRANSFORMERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. General purpose, dry type transformers.
2. Control and signal transformers.

1.2 REFERENCES

A. American National Standards Institute, Inc. /Institute of Electrical and Electronics Engineers (ANSI/IEEE):


B. National Electrical Manufacturers Association (NEMA):

1. NEMA LA 1-86 - Surge Arrestors.
2. NEMA ST 1-88 - Specialty Transformers (Except General-Purpose Type).
3. NEMA ST 20-86 - Dry-Type Transformers for General Applications.

C. Underwriters Laboratories, Inc. (UL):

1. UL 486A-80 - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
2. UL 506-89 - Specialty Transformers.

1.3 SUBMITTALS

A. Submit the following for the Port Construction Representative for approval.

B. Product Data:

1. Dimensional plans and sections.
2. Elevations showing minimum clearances.
3. Installed devices.
4. Materials list.
5. Weights.
6. Wiring diagrams.
7. Manufacturer’s nameplate data and electrical ratings.
C. Product Test Reports:

1. Certified copies of manufacturer's design and routine factory tests required by reference standards.
2. Submit after manufacture of transformer and before installation.

D. With each submittal, include a copy of the applicable specification(s) page(s) for the item submitted and mark "Complies" or "Non-Compliance" or "Exception" adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

1.4 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Terms "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:


1.5 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Square D.

B. General Electric.

C. Eaton.

D. Or equal.

2.2 TRANSFORMERS, GENERAL
A. Transformers:
   1. Factory-assembled and tested, air-cooled units of types specified, having characteristics and ratings as indicated.
   2. Design unit for 60 Hz service.
B. Cores: Grain-oriented, non-aging silicon steel.
C. Coils: Continuous windings without splices, except for taps.
D. Internal Coil Connections: Brazed or pressure type.
E. Bolt coil/core to bottom of enclosure for transformers larger than 15 kVA.
   1. Isolated by rubber, vibration-absorbing mounts.
   2. Metal-to-metal contact between coil/core and enclosure not allowed.
F. Provide copper windings.
G. Nameplates: Provide metal nameplate listing manufacturer's name, serial number, type, class, kVA voltage, frequency, and showing internal wiring diagram.
H. Sound Level: Minimum 3 dB less than sound levels for transformer type and size indicated when factory-tested in accordance with NEMA ST 20.

2.3 GENERAL PURPOSE, DRY TYPE TRANSFORMERS
A. Comply with NEMA ST 20.
B. Windings: 2-winding type. 3-phase transformers shall use one coil/phase in primary and secondary.
C. Transformers shall have following features and ratings.
   1. Enclosure: Indoor, ventilated unless otherwise shown on Drawings. Outdoor, moisture and rain-tight weatherproof, stainless steel.
   2. Insulation Class: 185°C or 220°C class for transformers 15 kVA or smaller; 220°C class for transformers larger than 15 kVA.
   3. Insulation Temperature Rise: 80°C maximum rise above 40°C for 15 kVA and larger; 115°C maximum rise above 40°C below 15 kVA.
   4. Taps: For transformers 3 kVA and larger, full capacity taps in high voltage winding as follows.
      a. 3 through 10 kVA: Two 5% taps below rated high voltage.
      b. 15 through 500 kVA: Six 2-1/2% taps, 2 above and 4 below rated high voltage.
      c. 750 through 1,000 kVA: Four 2-1/2% taps, 2 above and 2 below rated high voltage.
D. Accessories: Following accessory items are required where shown on Drawings.
1. Surge Arresters: Low voltage type, factory-installed and connected to high voltage terminals; complying with NEMA LA 1.
2. Wall Mounting Brackets: Manufacturer's standard brackets for transformers sized up to 75 kVA where wall mounting indicated.
3. Electrostatic Shielding: Insulated metallic shield between primary and secondary windings. Connect to terminal marked "shield" for grounding connection, where applicable.

2.4 CONTROL AND SIGNAL TRANSFORMERS

A. Comply with NEMA ST 1 and UL 506.

B. Ratings:
   1. As indicated and for continuous duty.
   2. Where rating not indicated, provide 125% of load.

C. Type: Self-cooled, 2-winding dry type.

D. Enclosure: Indoor, except as indicated otherwise on plans.

PART 3 EXECUTION

3.1 INSTALLATION

A. Arrange equipment to provide adequate spacing for cooling air circulation.

B. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values not indicated, use those specified in UL 486A and 486B.

C. Install wall-mounted transformers on prefabricated brackets designed for purpose.

D. Install floor-mounted transformers on 4-in. concrete housekeeping pad or, as otherwise shown on plans.

E. Touch up scratched or marred surfaces to match original finish.

F. Identify transformers as specified herein.

G. Install lightning arresters as shown on Drawings.
3.2 GROUNDING

A. Ground in accordance with applicable specification sections and plans.

3.3 FIELD QUALITY CONTROL

A. Inspect and test per NETA standards, Section 7.2 – Transformers.

3.4 ADJUSTING

A. Adjust transformer taps to provide optimum voltage conditions at utilization equipment.

3.5 CLEANING

A. Upon completion of installation, inspect interiors and exteriors of accessible components.
   1. Remove paint splatters and other spots, dirt, and construction debris.
   2. Touch up scratches and mars of finish to match original.

3.6 PROTECTION

A. Temporary Heating: Comply with manufacturer's written recommendations within enclosure of each transformer throughout periods during which equipment is not in a space continuously under normal control of temperature and humidity.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 24 13.00 Add – SWITCHBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Low-voltage power service and distribution switchboards and associated auxiliary equipment rated 600 V or less.

1.2 REFERENCES

A. Institute of Electrical and Electronic Engineers, Inc.
   2. IEEE C57.13-78 - Standard Requirements for Instrument Transformers.

B. National Electrical Manufacturers Association (NEMA): NEMA PB2-82 - Dead-Front Distribution Switchboards.

C. Underwriter Laboratory (UL): UL 891-84 - UL Standard for Safety Dead-Front Switchboards.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Submit for each switchboard.
   2. Include dimensioned plans and elevations, component and device lists, and single-line diagram showing main and branch bus current ratings and short time and short-circuit ratings of switchboard.
   3. Descriptive documentation of optional barriers specified for electrical insulation and isolation.
   4. Schedule of features, characteristics, ratings, and factory settings of individual protective devices.
   5. Manufacturer’s Schematic Wiring Diagram.
   6. Point-to-Point Control Wiring Diagram: Differentiating between manufacturer-installed and field-installed wiring.
   7. Time current characteristic curves for overcurrent protective devices including circuit breaker trip devices and fusible devices.
B. Product Data: Submit for each product and component specified.

C. Test Reports: Report of field tests and observations.

D. Submit to the Port Construction Representative for approval.

E. Operation and Maintenance (O&M) Data: Maintenance data for materials and products, for inclusion in Operating and Maintenance Manual specified.

F. (Omitted)

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:


B. Listing and Labeling: Provide switchboard assemblies that are listed and labeled.

1. Terms "listed" and "labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboard equipment including clearances between switchboard and adjacent surfaces and items. Switchboards having equal performance characteristics and complying with indicated maximum dimensions may be considered.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in shipping splits of lengths that can be moved past obstructions.

B. Store so condensation will not occur on or in switchboards. Provide temporary heaters as required to assure avoiding condensation.

C. Handle switchboards in accordance with NEMA Standard PB2.1. Use factory-installed lifting provisions.

1.6 MAINTENANCE

A. Extra Materials:

1. Spare Fuses: Six (6) spares of each type and rating of fuse and fusible devices used. Include spares for:
a. Potential transformer fuses.
b. Control power fuses.

2. Spare Indicating Lights: Six (6) of each type installed.

1.7  MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items which it is a component part.

PART 2  PRODUCTS

2.1  MANUFACTURERS

A. Square D Co.
B. Eaton.
C. General Electric
D. Or pre-approved equal.

2.2  SWITCHBOARDS, GENERAL

A. Description: Front-connected, front-accessible, with fixed, individually mounted main device, panel-mounted branches, and sections rear aligned.
   1. Main Device: Individually fixed mounted.
B. Barriers: Between adjacent switchboard sections.
C. Meet NEC requirements for service entrance.
D. Ratings: Provide nominal system voltage, continuous main bus amperage, and short-time and short-circuit-current ratings as indicated.
E. Comply with NEMA Standard PB2 2.

2.3  FABRICATION AND FEATURES

A. Enclosure: Steel, NEMA 1.
B. Enclosure Finish: Manufacture standard gray finish over rust inhibiting primer on phosphatizing treated metal surface. Provide painted surfaces that conform to IEEE C37.20.1.

C. Hinged Front Panels: Provide to allow access to breaker, metering, accessory, and blank compartments.

D. Buses and Connections: Three-phase, 3 wire except as otherwise indicated. Features as follows:
   1. Phase Bus Material: Tin plated, hard-drawn copper of 98% conductivity with feeder circuit-breaker line connections.
   2. At load terminals of feeder breakers, provide tin-plated copper bus extensions equipped with pressure terminal connectors for outgoing circuit conductors.
   3. Ground Bus: 1/4-in. by 2-in. minimum size, hard-drawn copper of 98% conductivity, and equipped with pressure connector terminations for feeder- and branch-circuit ground conductors. For busway feeders extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
   5. Main Phase Buses, and Equipment Ground Bus: Uniform capacity the entire length of switchboard main and distribution sections. Provide for future extensions from either end by means of bolt holes or other approved method and connecting links.
   6. Neutral Disconnect Link: For switchgear assembly having main service disconnect. Arrange to permit disconnecting the switchgear assembly neutral bus from the common ground bus and the incoming service neutrals. Also provide a bolted, uninsulated, 1/4-in. by 2-in. copper bus (main bonding jumper). Arrange to interconnect the neutral and the ground buses to establish the system common ground point.

2.4 OVERCURRENT PROTECTIVE DEVICES (OCPD’s)

A. Provide device features, ratings, and characteristics. Perform setting of all OCPD’s and make adjustments accordingly. Refer to Section 26 60 02.00 – “Protective Device Coordination” for additional requirements.

B. Future Devices: Where provision for future overcurrent protective devices or space is indicated, equip compartments with mounting brackets, supports, bus connections, and necessary appurtenances, designed for the OCPD types and ampere ratings indicated for future installation of devices.

2.5 INSTRUMENTATION

A. Instrument Transformers: NEMA standard EI 21.1, IEEE C57.13, and following:
   1. Current Transformers: Ratios as indicated and accuracy class suitable for connected relays, meters, and instruments.
   2. Control Power Transformers: Dry type. Separate compartments for units larger than 3 kVA and their primary and secondary fuses.
   3. Current Transformers for Neutral and Ground Fault Current Sensing: Ground/neutral sensor current transformers located as indicated. Connect secondaries to ground
overcurrent relays to provide selective tripping of bus tie and main breaker coordinated with feeder breaker ground fault protection.

B. Multifunction Digital Metering Monitor: UL listed or recognized microprocessor-based unit suitable for three- or four-wire systems and with following features:

1. Inputs: From sensors or current transformers from 100/5 through 5000/5 ratings and potential terminals up to 600 V.
2. Display: Switch selectable digital display of following values with maximum accuracy tolerances as indicated:
   a. Phase currents, each phase, plus or minus 1%.
   b. Phase-to-phase voltages, 3 phase, plus or minus 1%.
   c. Phase-to-neutral voltages, 3 phase, plus or minus 1%.
   d. Megawatts, plus or minus 2%.
   e. Megavars, plus or minus 2%.
   f. Power factor, plus or minus 2%.
   g. Frequency, plus or minus 0.5%.
   h. Megawatt demand with demand interval programmable from 5 to 60 minutes, plus or minus 2%.
   i. Accumulated energy, megawatt hours, plus or minus 2%. Accumulated values unaffected by power outages up to 72 hrs.
3. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door.
4. Provide data RS232 or RS485 connection for interface to future monitoring or SCADA system via Ethernet switch. See electrical plans for additional information.

2.6 CONTROL POWER

A. General: Where electrically operated devices or ground fault relays are indicated and require external power, provide 120-V control circuits supplied through secondary disconnect devices from control power transformer.

B. Control Power Fuses: Include primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory-installed, complete with bundling, lacing, and protection. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.7 IDENTIFICATION

A. Identify units, devices, controls, and wiring with factory-applied labels and signs.

B. Compartment Nameplates: Engraved laminated plastic nameplate for each compartment, mounted with corrosion-resistant screws.
PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install switchboards and accessory items in accordance with manufacturers' written installation instructions and the following specifications.

B. Where slab is indicated under switchboard, provide 4-in. high concrete housekeeping pad.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs.

3.3 CONNECTIONS

A. Tighten switchboard bus joint bolts and electrical connector and terminal bolts in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not stated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's technician for equipment specified herein shall be present at job site or classroom designated by The Port Construction Representative for a minimum of 1 workday, travel time excluded, for assistance during plant startup, equipment adjustment, and training of The Port Authority's personnel for plant operation. Include minimum of:
   a. 1 person-day for Instructional Services.
2. Supplier or manufacturer shall direct services to specific system and equipment operation, maintenance, and troubleshooting.


C. Pre-testing: Upon completing installation of system, perform following preparations for tests.

1. Make insulation resistance tests of switchboard buses, components, and connecting supply, feeder, and control circuits.
2. Make continuity tests of circuits.
D. Quality Control Testing Program: Conform to following.

1. Program Objectives: To assure switchboard installation meets specified requirements, is operational within specified tolerances, provides appropriate protection for systems and equipment, and is suitable for energizing.
2. Procedures: Make field tests and inspections and prepare switchboard for satisfactory operation in accordance with manufacturer’s recommendations and these specifications.
3. Schedule tests and notify Engineer at least 7 days in advance of test commencement.
5. Labeling: Upon satisfactory completion of tests and related effort. Apply a label to tested components indicating test results, person responsible, and date.
6. Protective Device Ratings and Settings: Verify indicated ratings and settings and make the final system adjustments of OCPD’s.

E. Visual and Mechanical Inspections: Include the following inspections and related work:

1. Inspect for defects and physical damage, testing laboratory labels, and nameplate compliance with up-to-date circuit connections.
2. Verify that potential transformers, including their overcurrent protection and current transformers meet specified requirements.
3. Perform operational test and exercise of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
4. Check switchboard anchorage, area clearances, and alignment and fit of components.
5. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
6. Clean switchboard interior and exterior using manufacturer's approved methods and materials.

F. Electrical Tests: Include following items performed in accordance with manufacturer's instruction:

1. Insulation resistance test of buses and portions of control wiring that disconnect from solid-state devices through normal disconnecting features. Insulation resistance less than 100 megohms is not acceptable.
2. Ratio and polarity tests on current and voltage transformers.
3. Ground resistance test on system and equipment ground connections.
4. Verify appropriate capacity, overcurrent protection, and operating voltage of control power elements including control power transformer and control power wiring.

G. Retesting: Correct deficiencies identified by tests and observations and retest switchboards. Verify by the retests that switchboards meet specified requirements.

3.5 CLEANING

A. Upon completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
3.6 PROTECTION

A. Temporary Heating: Apply temporary heat in accordance with manufacturer's recommendation within each section of switchboards throughout periods during which the switchboard is not in a space that is continuously under normal control of temperature and humidity.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for panelboards.

1.2 REFERENCES

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):
   1. NEMA AB1: Molded Case Circuit Breakers.
   2. NEMA PB1: Panelboards.
   3. NEMA PB1.1: Instruction for Safe Installation Operation and Maintenance of Panelboards rated 600 volts or less.

   NFPA No. 70 - National Electrical Code (NEC), Article 408 in 2008 - Switchboards and Panelboards.

C. Underwriters Laboratories (UL):
   1. UL 67 - Panelboards.
   2. UL 50 - Cabinets and Boxes.
   3. UL 514A - Metallic Boxes.

1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Construction Representative. At the minimum the following are required:
   1. Manufacturer’s literature and catalog data.
   2. Breaker arrangement.
   4. Instruction for handling and storage.
   5. Installation instructions.
   6. Dimensions and weights.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY STORAGE AND HANDLING

A. Have panelboards packed and crated to permit ease of handling and to provide protection from damage during shipping, handling, and storage.

1.6 MEASUREMENT AND PAYMENT

A. Payment for panelboards for ‘480 Volt Distribution Panels Complete’ with NEMA 4X Enclosure, Sun Shield, Equipment and Other Associated Devices shall be on a unit price basis for Each unit, including material, labor, and all other incidentals required, complete in place and accepted.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Sheet Metal Boxes:

1. Eaton Products.

2.2 MATERIALS AND EQUIPMENT

A. Basic Requirements:

1. Use panelboards manufactured and tested in accordance with NEMA PB 1.
2. Provide circuit breakers of industrial grade, manufactured and tested in accordance with NEMA AB 1 and Federal Specification FS W-C-375.
3. Do not exceed 42 available single pole branch circuits in any one panelboard.

B. Rating:

1. Voltage rating, current rating, number of phases, number of wires, and number of poles are indicated on Drawings.
2. Branch circuit breaker interrupting capacity shall be minimum 10,000 ampere RMS symmetrical for 240V; 25,000 ampere RMS symmetrical for 480V, or as shown on drawings.

C. Circuit Breakers: Molded case, bolt-on thermal magnetic type with number of poles and trip ratings as shown on the Drawings. Provide ground fault interrupters with trip rating where shown on the Drawings.

D. Bus System:
1. Bus Bars: 98 percent conductivity copper tin-plated like switchboard. Provide a solid neutral bar in 4-wire panelboards. Include ground bus in all panels.

2. Main: Circuit breaker or main lugs only as indicated on the Drawings or as required to meet the current interrupting ratings.

E. Box and Trim:

1. Construction: Code grade steel, ample gutter space, flush door, flush snap latch, and lock.

2. Trim: Surface or flush as required. Enclose panelboards located outdoors, or in other wet and corrosive areas in NEMA 4X weatherproof stainless steel enclosures. Enclose indoor panelboards in a NEMA 1 enclosure with manufacturer's standard gray enamel finish.

3. Directory: Typed card, with glass cover in frame on back of door giving the circuit numbers and the area or equipment served.

4. Paint: Standard with one bottle of touch-up.

F. Conduit Connectors: Watertight as manufactured by Myers Hubs, or approved substitution.

PART 3 EXECUTION

3.1 GENERAL

A. Review Drawings to verify that panelboards are correct for the application.

3.2 INSTALLATION

A. Install the panelboard in accordance with NEMA PB 1.1 and NEC Article 384.

B. Mount panelboards 5'-6" (to top of cabinet) above finished floor or grade.

C. In wet and corrosive areas, including outdoor locations, install panel enclosures on spacers to provide approximately 1/4-inch between back of cabinet and mounting surface.

D. In wet and corrosive areas, including outdoor locations, connect conduit to the bottom of enclosure and to the lower 30 percent of the sides using watertight connectors.

3.3 TESTING

A. General: At the time of testing, the Contractor must have completed all the cable connections as shown in the drawings. The cables must have been tested prior to connecting and directory completed.

B. Visual: Perform a visual check before energizing to see all the cables are connected, ground connections are made, breakers are operating in ON/OFF position, door operation is acceptable, conduit connections are made rigid with locknuts and Myers hubs installed (if applicable) and directory is completed.

C. Performance Test:

1. Energize the panel and measure the voltages on incoming bus and on all breakers both single phase and three phases.
2. Submit test results to the Port Construction Representative.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for cabinets and enclosures for housing Electrical Equipment.

1.2  REFERENCES

A. National Electrical Manufacturers Association (NEMA):

1. 250 - Enclosures for Electrical Equipment (1000 volts maximum).
2. NEMA 3R - Enclosures for outdoor use primarily to provide a degree of protection against wind-blown dust, rain, and sleet; undamaged by formation of ice on the enclosure.
3. NEMA 12 - Enclosures for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.
4. NEMA 4X – Enclosures for outdoor use to provide a degree of protection of wind-blown dust, rain, and sleet and added protection from corrosion.


NFPA 70 - National Electrical Code (NEC), Article 373 - Cabinets, Cutout Box, and Meter Socket Enclosures.

C. Underwriters Laboratories (UL):

1. UL 50 - Cabinets and Boxes.
2. UL 514A - Metallic Outlet Boxes.
3. UL 514B - Fittings for Boxes.

1.3  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Construction Representative. At the minimum, the following are required:

1. Manufacturer’s literature and catalog data.
2. Instruction for handling and storage.
3. Installation instruction.
4. Dimensions and weights.
5. UL listing certificates.
1.4 QUALITY ASSURANCE
A. Protection: All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage.

All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY STORAGE AND HANDLING
A. Have cabinets and enclosures packed and crated to permit ease of handling and to provide protection from damage during shipping, handling, and storage.

1.6 MEASUREMENT AND PAYMENT
A. Payment for ‘120V Power Enclosure and Communication Enclosure at Base of High Mast Light Pole’ shall be on a unit price basis for Each light pole (two enclosures per Each pole), including material, labor, and all other incidentals required, complete in place and accepted.
B. Payment for ‘ Temporary Camera Enclosures’ shall be on a unit price basis for Each pole location, including material, labor, and all other incidentals required, complete in place and accepted.
C. No separate payment shall be made for other miscellaneous cabinets and enclosures provided under this section. Include costs associated with these units in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. The EMF Company.
B. Hennessey Products, Inc.
C. Hoffman Industrial Products.
D. Pauluhn Electric Manufacturing Company.
E. Weigman Company.
F. Rose Enclosure.
H. Appleton.
I. Cooper Crouse Hinds.
J. Or approved substitution.
2.2 MATERIALS AND EQUIPMENT

A. Sheet Metal Boxes:

1. Provide enclosures manufactured in accordance with NEMA 250 and NEC Article 373. Fabricate outdoor NEMA 3R panels from 0.125- inch thick type 5052 H32 aluminum, NEMA 4X panels from 14 gauge, 316 stainless steel. NEMA 12 indoor panels shall be painted steel.
2. Dimensions and special features are shown on the Drawings.
3. Construct outdoor enclosures with continuously welded seams ground smooth.
4. Additional material thickness and bracing requirements shall be determined by the manufacturer to provide the strength required by the standard listed. The bracing shall be provided in such a way as to minimize the protrusion into the wiring and the equipment spaces.
5. Install the door with a stainless steel continuous hinge, stainless steel padlock handle with gasket and stainless steel hardware.
6. Furnish the door with oil-resistant neoprene gasket attached with oil-resistant adhesive and held in place with aluminum retaining strips.
7. Use a single, 3/4-inch minimum, door handle that provides a 3-point latching through latch rods with rollers. Provide rollers with at least 3/4-inch diameter.
8. Gasketed overlapping doors may be used instead of a center post.
9. Provide heavy-duty lifting eyes of suitable material.
10. Fabricate the enclosure with a stud-mounted panel inside. Make panels from 12-gauge steel painted with white enamel finish.
11. Equip both NEMA 12, NEMA 4X, and NEMA 3 enclosures with thermostatically controlled space heaters and corrosion inhibitors. Provide heaters rated for 240V for 120V operation.
12. Weld mounting feet to the enclosure if called for on the Drawing.
13. Include a high impact plastic data pocket in the enclosure.
14. Provide ground connections on the enclosures to enable grounding of the enclosure with a No. 2 AWG conductor.
15. Equip freestanding outdoor cabinets with inner and outer door restraint bars to prevent door swing during windy conditions.
16. Supply indoor enclosures with filtered passive air intake and exhaust openings, 4-inch square in the side near the top and near the bottom of the adjacent side panel.

B. Mounting Hardware: Stainless steel.

C. Conduit Connectors: Watertight as manufactured by Myers Hubs, or approved substitution.

D. Additional Requirements: Enclosures for switches, circuit breakers, or devices located upstream of Automatic Power Factor Correction Units (APFCU) may require additional space and conductor arrangements for remote mounted C.T. and P.T. devices associated with APFCU. Coordinate with Section 26 09 13.00 – “Automatic Power Factor Correction.”

2.3 TESTING

A. Test cabinets and enclosures in accordance with UL 50 so unit qualifies for a UL label.
PART 3 EXECUTION

3.1 PREPARATION

A. Review Drawings and determine how many enclosures of each kind are required and check if supplied quantity is sufficient.

B. Check the mounting pads or foundations for proper mounting dimensions and features, including grounding conductor stub-up.

3.2 INSTALLATION

A. Use enclosures described in this specification only above grade.

B. Install enclosures in accordance with NEC Article 373 in locations as indicated on the Drawings.

C. Install enclosures in readily accessible locations to facilitate general operations, wire pulls, maintenance, and repair.

D. Plug unused conduit openings.

E. Make conduit connections to the enclosures with watertight conduit connectors and ground properly.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for wiring devices including:

1. Receptacles.
2. Wall switches.
3. Wall plates and cover plates.

1.2 REFERENCES

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):
   1. NEMA WD1 - General Purpose Wiring Devices.
   2. NEMA WD6 - Dimensional Requirements.

B. Federal Specifications (WC-596F).

C. American National Standards Institute/National Fire Protection Association (NFPA):
   NFPA No. 70 - National Electrical Code (NEC), Articles 210 Branch Circuits, 250 Grounding and Luminaires.

1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Contractor shall submit the following:

1. Product Data: Manufacturer's product literature and specifications including dimensions, weights, certifications, and instructions for handling, storage, and installation.

1.4 DELIVERY, STORAGE AND HANDLING

A. Pack and crate devices to permit ease of handling and protect from damage during shipping, handling, and storage.

1.5 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.
PART 2  PRODUCTS

2.1  ACCEPTABLE MANUFACTURERS

A. Bryant Electric.
B. Copper Crouse-Hinds, Arrow Hart Division.
C. Hubbel Inc. Wiring Devices Division.
D. Leviton Manufacturing Company.
E. Pass & Seymour/Legrand.

2.2  MATERIALS AND EQUIPMENT

A. Standards: Conform to NEMA WD1 for general requirements and NEMA WD6 for dimensional requirements.
B. Manufacture devices to heavy-duty industrial specification grade with brown nylon bodies (orange for isolated-ground receptacles) back and side wiring provisions and green-colored grounding screws.
C. Receptacles:
   1. Duplex-type receptacles: Rated 20 amps at 120 volts.
   2. Contacts: Brass or phosphor bronze.
   3. Receptacle grounding system: Extend to the mounting strap unless isolated ground is indicated or required.
   4. GFI or GFCI (ground fault circuit interrupter) receptacles: Provide feed-through type with test and reset button.
D. Wall Switches:
   1. Toggle switches: Rated 20 amps at 120/277 volts AC rated for both resistive and inductive loads.
   2. Contacts: Silver cadmium oxide construction to prevent sticking, welding and excessive pitting.
E. Cover Plates:
   1. In outdoor, corrosive, and wet areas, provide cover plates of cast metal, gasketed with spring-loaded hinged covers and stainless steel hardware.
   2. All other plates: Type 302 stainless steel.

PART 3  EXECUTION

3.1  PREPARATION

A. Verify that device boxes are correctly placed.
B. Verify that the correct quantity, size, and type of wires are pulled to each device box.
C. Verify that wiring has been checked at both ends.
D. Prepare wire ends for connection to devices.
E. Inspect each wiring device for defects.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install devices plumb and level.
C. Install switches with OFF position down.
D. Install receptacles with grounding pole on top.
E. Connect wiring device grounding terminal to outlet box with bonding jumper.
F. Connect wiring devices by wrapping conductors clockwise around screw terminals.
G. Install cover plates on switch, receptacle, and blank outlets in finished areas.
H. Energize and test devices for proper operation.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 28 00.00 Add – OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.0 CONDITIONS

A. Subject to the General and Special Conditions, this Section includes specifications for overcurrent protective devices.

B. Refer to Section 26 00 01.05 - “Basic Electrical Requirements” for additional requirements.

1.1 SUMMARY

A. Section Includes: Overcurrent protective devices (OCPD’s) rated 600 V and below and switching devices commonly used with them.

1.2 REFERENCES

A. National Electrical Manufacturers Association (NEMA).

1. NEMA KS-1-83 - Enclosed Switches.
2. NEMA 250-85 - Enclosures for Electrical Equipment (1000 Volts Maximum).
3. NEMA FU1-86 - Low Voltage Cartridge Fuses.
4. NEMA AB1-86 - Molded Case Circuit Breakers and Molded Case Switches.


D. Underwriters Laboratory (UL):

1. UL 98-87 - Enclosed and Dead Front Switches.
1.3 DEFINITIONS

A. Overcurrent Protective Device (OCPD): Device operative on excessive current that causes and maintains interruption of power in circuit it protects.

B. Ampere-Squared-Seconds: Expression of available thermal energy resulting from current flow. With regard to current-limiting fuses and circuit breakers, ampere-squared-seconds during fault current interruption represents energy allowed to flow before fuse or breaker interrupts fault current within its current limiting range.

1.4 SUBMITTALS

A. Submit all products covered under this specification for Port Construction Representative’s approval.

B. Shop Drawings: Spare fuse cabinet showing dimensions and features including storage provision for fused cartons, where shown on plans.

C. Product Data:
   1. Product data for fuses, fusible switches, circuit breakers, and OCPD accessories specified in this Section, including descriptive data and time-current curves for protective devices and let-through current curves for those with current limiting characteristics.
   2. Include coordination charts and tables and related data.

D. Test Results: Certified reports of field tests and observations.

E. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

F. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following are required:
   1. Manufacturer's cut sheets, catalog data, and sizes.
   2. Installation, terminating and splicing procedure.
   3. Instruction for handling and storage.
   6. Conformance certificate.

G. Coordination: Contractor shall determine size, horsepower, voltage, and phase of all equipment and motors supplied and shall adjust breaker and fused switch size accordingly and shall note on submittals.
H. Submittal shall be in compliance with conditions specified in Section 26 60 02.00 – “Protective Device Coordination.”

1.5 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. Components and Installation:
   a. NFPA 70 "National Electrical Code (NEC)."
   b. Local codes and ordinances.

C. Single-Source Responsibility: Obtain similar OCPD’s from single manufacturer.

D. Coordinate OCPD sizes with characteristics of motors supplied for this project. Pay special attention to high efficiency motors.

E. Handle operator mechanisms shall be on side of enclosure and not on front. Keyed mechanisms that separate handle from breaker mechanism when door is opened are not acceptable.

1.6 MAINTENANCE

A. Extra Materials:

1. Maintenance Stock, Fuses: For types, voltage, and ampere ratings required, furnish 10% spare fuses, but not less than one set of three of each kind.

1.7 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 OVERCURRENT PROTECTIVE DEVICES (OCPD’S), GENERAL

A. General: Provide OCPD’s in indicated types, as integral components of panelboards, and switchboards, and also as individually enclosed and mounted single units.
B. Enclosures: In all outdoor areas and environmentally harsh locations, enclosures shall be NEMA 4X stainless steel.

2.2 GENERAL FUSES

A. General: Provide fuses of types, classes, and current ratings as indicated. Voltage ratings shall be consistent with circuits on which used.

B. Fuses for Direct Current Circuits: UL 198L and marked for such use by manufacturer on fuse label.

C. Cartridge Fuse:
   1. Manufacturers:
      a. Bussmann Div., Cooper Industries, Inc.
      b. Gould Shawmut.
      c. Littelfuse Inc.
   2. NEMA Standard FU1, unless indicated otherwise, provide nonrenewable cartridge fuses of indicated types, classes, and current ratings that have voltage ratings consistent with circuits on which used.
   3. Class CC Fuses: UL 198C.
   4. Class J Fuses: UL 198C.
   5. Class L Fuses: UL 198C.
      a. Current limiting threshold of 10 times current rating or less and time delay of 4 sec at 5 times rating.
   6. Class RK1 and RK5 Dual Element Time-Delay Fuses: UL 198E.
   7. Class RK1 Fast-Acting Fuses: UL 198E.

2.3 FUSIBLE SWITCHES

A. Manufacturers:
   1. Square D Co.
   2. General Electric
   3. Eaton Corp.
   4. Or approved equal.

B. UL 98 and NEMA KS 1 quick-make, quick-break heavy-duty units.

C. Rating: Load-breaking capacity in excess of normal horsepower rating for switch.

D. Withstand Capability: In excess of let-through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.

E. Operation: By means of external handle.

F. Interlock: Prevents access to switch interior except when in "off" position.

G. Fuse Clips: Rejection type.
H. Padlocking Provisions: For 2 padlocks, whether open or closed.

I. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting where indicated.

J. Enclosure for Switchboard Mounting: Provide individual mounting where indicated.

K. Enclosure for Independent Mounting: NEMA Type 0 as indicated or required to suit environment where located, except all outdoor areas and environmentally harsh locations shall be NEMA 4X stainless steel.

2.4 FUSED POWER CIRCUIT DEVICES – (WHERE SHOWN ON PLANS)

A. Manufacturers:
   1. Eaton Corp.
   2. Square D Co.
   3. Or equal.

B. UL 977, with either bolted-pressure-type or high-pressure contact-type switch.

C. Operation: As indicated.

D. Ground Fault Protection: Integral, self-powered type with mechanical ground fault indicator, test function, adjustable pick-up current and delay time with inverse and constant time characteristics, internal memory arranged to integrate intermittent arcing ground faults, and ground fault current sensor located as indicated.

E. Open Fuse Trip Device: Arranged to trip switch open if phase fuse opens.

F. Enclosure for Switchboard Mounting: Suitable for individual mounting.

G. Enclosure for Independent Mounting: NEMA Type 1 enclosure, as indicated or as required to suit environment where located.

H. Minimum Fault Current Rating: As indicated.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers Except as Indicated Otherwise on Plans:
   1. Square D Co.
   2. General Electric
   3. Eaton Corp.
   4. Or approved equal.

B. UL 489 and NEMA AB 1.
C. Construction: Bolt-in type, except breakers in load-center-type panelboards and breakers 225-ampere frame size and larger may be plug-in type if held in place by positive locking device requiring mechanical release for removal.

D. Characteristics: Indicated frame size, trip rating, number of poles, and short-circuit interrupting capacity rating of 10,000 amperes symmetrical, unless greater rating is indicated on Drawings.

E. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole.

F. Adjustable Instantaneous Trip Devices: Factory adjusted to low-trip-setting current values.

G. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting in switchboard or panelboards where indicated.

H. Enclosure for Switchboard Mounting: Provide individual mounting where indicated.

I. Enclosure for Independent Mounting: NEMA 4X stainless steel outdoor or damp environments, NEMA 1 stainless steel indoor enclosures, as indicated or required to suit environment where located. Handle operator mechanisms shall be on side of enclosure and not on front. Keyed mechanisms that separate handle from breaker mechanism when door is opened are not acceptable.

J. Combination Circuit Breakers and Ground-Fault Circuit Interrupters: UL 943 arranged for sensing and tripping for ground-fault current in addition to overcurrent and short-circuit current.
   1. Match features and module size of panelboard breakers and provide clear identification of ground fault trip function.
   2. Trip Setting for Ground Fault: 4 to 6 milliamperes listed and labeled as Class A, Type 1 device.
   3. Trip Setting for Ground Fault: 30 milliamperes.

K. Current-Limiting Circuit Breakers: Arranged to limit let-through ampere-squared-seconds during fault conditions to value less than ampere-squared-seconds of one-half-cycle wave of prospective symmetrical fault current. Circuit breaker shall use no fusible devices in its operation. Current-limiting characteristic shall be in addition to normal time-delay and instantaneous-trip characteristics and other features as indicated.

L. Circuit Breakers With Solid-State Trip Devices: Provide indicated circuit breakers with solid-state trip devices having following features:
   1. Ambient Compensation: Trip device insensitive to temperature changes between minus 20°C and plus 55°C.
   2. Adjustability: Breaker ratings and trip settings shall be changeable by operation of controls on front panel of breaker, by change of plug-in element without removing breaker from mounting, or by combination of two methods.
4. Provide clear plastic shield limiting access to rating plug and adjustments on solid-state trip circuit breaker. Seal by attaching sealing wire through hole in posts provided. With wire seal installed, circuit breaker rating plug and adjustments shall not be "readily accessible."

2.6 INSULATED-CASE CIRCUIT BREAKERS

A. Manufacturers:
   1. Square D Co.
   2. General Electric
   3. Or approved equal.

B. UL 489 and NEMA AB 1.

C. Ratings: Continuous-current, interrupting, and short-time-current ratings, and voltage and frequency ratings as indicated.

D. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with following features:

   1. Moving Contacts Closing Speed: Independent of both control and operator.

E. Circuit-Breaker Trip Devices: Solid-state overcurrent trip device system that includes one (1) integrally mounted current transformer or sensor per phase, release mechanism, and following features:

   1. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, which are independent of each other in both action and adjustment.
   2. Temperature compensation to assure accuracy and calibration stability from minus 20°C to plus 55°C.
   3. Field-adjustable, time-current characteristics.
   4. Current Adjustability: Effected by operating controls on front panel or by changing plug-in elements or current transformers or sensors.
   6. Five pickup points, minimum, for long-time- and short-time-trip functions.
   7. Six pickup points, minimum, for instantaneous-trip functions.
   9. Trip Indication: Labeled lights or mechanical indicators on trip device shall indicate type of fault causing breaker trip. If lights are used, integral power source shall maintain indication for 60 hrs, minimum.

F. Auxiliary Contacts for Remote Indication: Where remote indication of breaker position is indicated, provide spare auxiliary switch in addition to other auxiliary switches required for normal breaker operation. Spare auxiliary switch shall consist of two Type "a" and two Type "b" stages (contacts), wired to terminal block in breaker housing.
G. Draw Out Features: Where indicated on plans, provide circuit-breaker mounting
assembly equipped with racking mechanism that properly positions power circuit breaker
and holds it rigidly in connected, test, and fully disconnected positions and includes
following features:

1. Interlock arrangement, preventing movement of circuit breaker to or from
connected position when it is in closed position and closure of circuit breaker
unless it is in connected, test, or disconnected position.
2. Construction, permitting racking open circuit breaker to or from connected, test,
and disconnected positions with associated compartment door closed or
equivalent dead-front barrier protection, and manual withdrawal to position for
removal from structure with door open.
3. Primary disconnecting devices disengaged and secondary disconnecting devices
engaged when breaker is in test position.
4. Primary and secondary devices disengaged when circuit breaker is in
disconnected position.
5. Ground contact engaged when circuit-breaker element is in connected and test
positions.

H. Circuit-Breaker Features and Accessories: Include following:

1. Padlocking Provisions: For installing at least two padlocks on each breaker to
secure its enclosure and prevent movement of draw out mechanism.
2. Operating Handle: Provide one for each manually operated breaker. No handle
ties are permitted.
3. Electric Close Button: Provide one for each electrically operated breaker.
4. Indicating Lights: Contacts for "Breaker Open" and "Breaker Closed," for main
and bus tie circuit breakers, and for other indicated breakers.

2.7 OCPD ACCESSORIES

A. Key Interlocks: Arrange interlocking so keys are held captive at devices indicated.
Where future key interlocking provisions are indicated, provide necessary mountings and
hardware as required for future installation.

B. Instantaneous Undervoltage Trip Device: For indicated OCPD’s.

C. Adjustable-Time-Delay Undervoltage Trip Devices: For indicated OCPD’s.

D. Shunt-Trip Devices for Circuit Breakers: Where indicated on plans arrange to trip
breaker from external source of power through control switch or relay contacts.

2.8 ENCLOSURES

A. Where OCPD’s are installed in enclosures. Provide for operating via external lockable
handle without removing a cover or a bolted-on plate. Lockable hinged door access is
acceptable where approved by The Port Construction Representative or where required
by enclosure classification.
B. Coordinate enclosure size and construction to accommodate additional potential or current transformers associated with automatic power factor correction units where required. See Section 26 09 13.00 – “Automatic Power Factor Correction” for additional requirements. Coordinate bus bar installation with any required current transformers or potential transformers.

2.9 TERMINATION DEVICES

A. Provide wiring terminals and cable lugs of adequate size and quantity to accommodate all of the required conductors and cables.

PART 3 EXECUTION

3.1 INSTALLATION

A. Fuses: Install fuses in fusible devices indicated.

B. Independently Mounted OCPD's: Locate as indicated and install in accordance with manufacturer's written installation instructions.

C. Factory install OCPD's furnished in distribution equipment.

D. Coordinate size overcurrent protective devices with each motor and equipment manufacturer to assure correct size devices and provide accordingly.

3.2 APPLICATION OF FUSES

A. Control Circuits: Class CC, time delay.

B. General Purpose Fusible Switches: Apply following class and types:

   1. 30-600 Amperes: Class J or RK1, time delay.
   2. 601-6,000 Amperes: Class L, time delay.
      a. Size at 125% of motor FLA not to exceed 150%.
      b. For transformers, size per NEC Table 450.3 (B).
      c. Size at 100% of load for mains and feeders with non-inductive loads.

3.3 IDENTIFICATION

A. Identify with components as specified in Section 26 05 53.00 – “Electrical Identification.”
3.4 CONTROL WIRING INSTALLATION

A. Install wiring between OCPD’s and control/indication devices as specified in Section 26 05 19.00 – “600 Volt Building Wire and Cable” for hard-wired connections.

3.5 CONNECTIONS

A. Check connectors, terminals, bus joints, and mountings for tightness.

B. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.6 GROUNDING

A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.7 PROTECTIVE DEVICE COORDINATION STUDY

A. The Electrical Engineer of Record will perform the protective device coordination study in accordance with Section 26 60 02.00 – “Protective Device Coordination.”

3.8 PROTECTIVE DEVICE SETTINGS

A. The Contractor shall secure the services of a qualified firm to perform setting of overcurrent protective devices in accordance with Section 26 60 02.00 “Protective Device Coordination.”

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's technician for equipment specified herein shall be present at job site or classroom designated by Port Construction Representative for minimum of 1/2 workday, travel time excluded, for assistance during plant construction, plant startup, equipment adjustment, and training of Port Construction Representative’s personnel for plant operation. Include minimum of:
   a. One half (½) person-day for Instructional Services.

2. Supplier or manufacturer shall direct services to specific system and equipment operation, maintenance, and troubleshooting.
B. Testing:

1. Tests shall be in compliance with NETA-ATS Standards.
2. Reports: Prepare certified written reports on tests and observations. Report defective materials, workmanship, and unsatisfactory test results. Include complete records of repairs and adjustments made.
3. Labeling: Upon satisfactory completion of tests and related effort, apply label to tested components indicating test results, date, and responsible person.
4. Schedule visual and mechanical inspections and electrical tests with at least 1 week's advance notification.
5. Pre-testing: Upon completing installation of system, perform following preparations for tests:
   a. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
   b. Make continuity tests of circuits.
   c. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
   d. Comply with manufacturer's instructions for installation and testing of OCPD's.
6. Visual and mechanical inspection: Include following inspections and related work.
   a. Overcurrent-Protective-Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make final system adjustments.
   b. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.
   c. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
   d. Check tightness of electrical connections of OCPD's with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
   e. Clean OCPD's using manufacturer's approved methods and materials.
   f. Verify installation of proper fuse types and ratings in fusible OCPD's.
7. Electrical Tests: Include following items performed in accordance with manufacturer's instructions:
   a. Insulation resistance test of OCPD conducting parts. Insulation resistance less than 100 megohms is not acceptable.
   b. Verify trip unit reset characteristics for insulated-case circuit breakers.
   c. Make adjustments for final settings of adjustable-trip devices.
   d. Activate auxiliary protective devices such as ground fault or undervoltage relays, to verify operation of shunt-trip devices.
   e. Check stored-energy charging motors for proper operation of motor, mechanism, and limit switches.
   f. Check operation of electrically operated OCPD's in accordance with manufacturer's instructions.
   g. Check key and other interlock and safety devices for operation and sequence. Make closing attempts on locked-open and opening attempts on locked-closed devices including moveable barriers and shutters.
8. Retest: Correct deficiencies identified by tests and observations and retest. Verify by system tests that specified requirements are met.

3.10 CLEANING

A. Upon completion of installation, inspect OCPD’s. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 28 16.00 Add – DISCONNECT SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for disconnect switches fusible and non-fusible, circuit breaker type, fuses and circuit breakers.

1.2 REFERENCES

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):
   1. NEMA AB1 - Molded Case Circuit Breakers.
   2. NEMA KS1 - Enclosed Switches.

B. Underwriters Laboratories (UL):
   1. UL 98 - Standard for Safety Enclosed Switches and Dead Front Switches.
   2. UL 198C - High Interrupting Capacity Fuses, Current Limiting Type.
   3. UL 198-3 - CL-K Fuses.
   4. UL-198-4 - CL-R Fuses.

C. American National Standards Institute/National Fire Protection Association (ANSI/NFPA):
   NFPA No. 70 - National Electrical Code (NEC), Article 404 - Switches.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Construction Representative. At the minimum, the following are required:

   1. Manufacturer's literature and catalog data.
   2. Switch internal arrangement.
   3. Breaker or fuse characteristic curves.
   4. Instructions for handling and storage.
   5. Installation instructions.
   6. Dimensions and weights.
1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage.

   All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.5 DELIVERY, STORAGE AND HANDLING

A. Have disconnect switches packed and crated to permit ease of handling and to provide protection from damage during shipping, handling and storage.

1.6 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Disconnect Switches and Circuit Breakers:
   1. Eaton Products.
   2. General Electric.
   4. Square D Company.
   5. Or approved substitution.

B. Fuses:
   1. Bussman Division, Cooper Industries.
   2. Gould Shawmut.
   3. LittleFuse Incorporated.

2.2 MATERIALS AND EQUIPMENT

A. Disconnect Switches:
   1. Characteristics: Horsepower rated, 600-volt, heavy-duty type with an interlocked door, positive quick-make, quick-break mechanism and visible blades, front operating handle, arc chute and reinforced fuse holders CL-R Rejection type.
   2. Use switches and components designed, manufactured, and tested in accordance with NEMA AB1, NEMA KS1, UL 98, and NEC Article 380.
   3. Enclose switch in NEMA 4X (type 316 stainless steel) in outdoor locations or other wet or corrosive areas.
   4. Provide switches with provisions for padlocking the operating lever in OFF position and door in closed position.
   5. Select switches having the number of poles and general size conforming to the Drawings.
6. Conform to fusible, non-fusible or circuit breaker type switch requirements as shown on Drawings or one-line diagrams.

7. Provide an auxiliary contact, if shown on the Drawings. Select fuses or circuit breakers with current interrupting duty as calculated for the points of switch application or as indicated on the Drawings or one-line diagrams.

8. Provide a nameplate.

9. Select fuses or circuit breakers with current interrupting duty as calculated for the points of switch application or as indicated on the Drawings or one-line diagrams.

B. Fuses:

1. Provide fuses for all fusible switches indicated on drawings.

2. Ratings: Sizes shall be as indicated on drawings. Fuse types and capacities shall be as follows:
   a. Electric Service: UL Class L, Type KRP-C, time delay, current limiting; 200,000 amp interrupting rating.
   b. Main Distribution Switchboard: UL Class RK5, Type LPN-R time delay, current limiting; 200,000 amp interrupting rating.

3. Current Limiting Fuses: Silver-sand type, capable of interrupting safely short circuit currents of up to 200,000 amperes symmetrical.

4. Coordination: The fuses as installed shall provide proper selective coordination in the system and shall provide proper back-up protection for all equipment not designed to carry or interrupt the full short circuit current available at the point of application.

5. Fuse Clips: The fuses shall fit rejection type fuse clips only to prevent changing of specified fusing of system.

6. Spares: Provide fuses of each fuse type, capacity, and size as required for all equipment. At the completion of the project, provide for each separate type and rating of fuse not less than 30% spare fuses and in no case less than three (3) fuses for each size and rating.

7. Fuse Replacement: Supply replacements for all fuses cleared during construction including those fuses, which clear due to malfunction or testing of HVAC or Plumbing Equipment.

C. Circuit Breakers: When circuit breakers are used in disconnect switches, provide the thermal-magnetic type with current interruption ratings as required at the point of application.

D. Conduit Connectors: Watertight as manufactured by Myers Hubs, or approved substitution.

PART 3 EXECUTION

3.1 PREPARATION

A. Review the Drawings and verify that the disconnect switches are correct for the applications.

B. Make sure that the correct fuses or breakers are being used regarding size and short circuit interrupting capability.

C. Prepare adhesive labels on the inside door of each switch indicating UL fuse class and size or breaker type and size for replacement.
3.2 INSTALLATION

A. Install a disconnect at each point of the power distribution system as shown or specified.

B. Install disconnects furnished under other contracts at locations as shown on the drawings.

C. Mount disconnect on spacers or galvanized steel channels to permit a minimum of 1/2-inch clearance from walls.

D. Install fuses in disconnects, sizes and ratings as shown or specified.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 41 13.02 Add – LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specification for lightning protection system for High Mast Lighting Poles.

1.2 REFERENCES

A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA):

2. NFPA No: 70 - National Electrical Code:
   a. Section 250.106 - Spacing from Lightning Rods.
   b. Section 250.60 - Use of Lightning Rods

B. Underwriters Laboratories (UL):

1. UL 96 - Lightning Protection Components.
2. UL 96A - Safety Installation Requirements for Lightning Protection System.


1.3 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port Construction Representative. At the minimum, the following are required:

1. Manufacturer’s literature and catalog cuts.
2. Outline dimensions and weights.
4. Instructions for storage and handling.

1.4 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.
1.5 DELIVERY STORAGE AND HANDLING
A. Pack and crate materials to permit ease of handling and provide protection from damage during shipping, handling, and storage.

1.6 MEASUREMENT AND PAYMENT
A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Advanced Lightning Technology
B. East Coast Lightning Equipment
C. Harger Lightning Protection
D. Thompson Lightning Protection
E. Or approved equal

2.2 DESIGN, CONSTRUCTION AND MATERIALS
A. System Design: Provide a functional and unobtrusive lightning protection system. Departures from the Drawings or submittals shall be submitted to the Port Construction Representative for approval. Provide Class II sized components; Class II sized components are utilized on roof levels 75 feet and above in height.
B. Lightning Protection Equipment: Materials shall be copper and bronze and of the size, weight, and construction to suit the application and used in accordance with PLI, UL, and NFPA code requirements. Use bolt type connectors and splicers for Class II structures. Pressure squeeze clamps are not acceptable. Use stainless steel mounting hardware to prevent corrosion.
C. Aluminum Components: Aluminum materials may not be used. Use copper down leads and grounding components.
D. Use equipment that is UL listed and properly UL labeled. Equipment shall be new, and of a design and construction to suit the application in accordance with accepted industry standards and LPI, UL, NFPA, and NEC code requirements.

PART 3 EXECUTION

3.1 PREPARATION
A. The Contractor is responsible for the following coordination with the building contractors:
B. The lightning protection installer shall install a correct, neat, and unobtrusive installation in cooperation with other trades.
3.2 INSTALLATION

A. The system shall be installed by an experienced personnel or a company that is a member of the Lightning Protection Institute and an employer of Certified Master Installers of lightning protection systems.

B. A certified Master Installer shall directly supervise the work. Install equipment in a neat, workmanlike manner. Provide and install a complete conductor network and include air terminals, connectors, splices, bonds, copper down leads, and proper ground terminals.

C. Use copper down lead conductors. Do not bring down lead conductors in conduit. Structural steel may be utilized in the installation as outlined by UL, NFPA, and LPI.

D. Down lead conductors shall be tied to the ground rod pit at the base of the pole as indicated on the drawing.

E. The ground resistance shall be tested after completion to ensure the resistance to ground is no more than 1-ohm. If this value is exceeded, the Contractor shall install additional ground rods until a value less than 1-ohm is obtained.

F. Upon completion of the installation, the lightning protection installer shall secure and deliver to the Contractor for submittal to the Chief Engineer, the Underwriters Laboratories, Inc., Master Label certification and the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate and the LPI certification certificate.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 56 29.00 Add – HIGH MAST LIGHTING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes requirements for high mast full cut-off lighting system.

1.2 REFERENCES

A. The following is a listing of the publications referenced in this Section:

1. National Fire Protection Association (NFPA):
   a. NFPA 70 - National Electrical Code

2. American Association of State Highway and Transportation Officials (AASHTO):
   a. AASHTO LTS- 4 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

3. American National Standards Institute (ANSI):
   a. No. 70 - National Electrical Code (NEC).
   b. C78.379 - Electric Lamps - Incandescent and High Intensity discharge Reflector Lamps - Classification of Beam Patterns.
   c. C82.4 - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
   d. IES Illuminating Engineering Society (ANSI/IES) Handbook shall be used as a basis for design and construction of lighting systems.

   a. ASTM A 36 - Carbon Structural Steel.
   c. ASTM A 143 - Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   d. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   e. ASTM A 615 - Deformed and Billet-Steel Bars for Concrete Reinforcement.
   f. ASTM A 572 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   g. ASTM A 595 - Steel Tubes, Low-Carbon, Tapered for Structural Use.

5. American Institute of Steel Construction (AISC):

6. American Welding Society (AWS):
   a. AWS D 1.1 & D 1.5 - Structural Welding Code, Steel.

7. Underwriters Laboratories (ANSI/UL):
   a. UL1572 - High Intensity Discharge Lighting Fixtures.
1.3 DESIGN AND PERFORMANCE REQUIREMENTS

A. The high mast full cut-off lighting system shall be furnished, supplied, installed, adjusted, and tested in accordance with this Section and as specified on the Contract Drawings.

B. The high mast lighting poles shall be designed in accordance with AASHTO LTS-2, the local Building Code and the provisions of the AISC Specifications. In case of conflict, the more stringent requirement shall govern. The poles shall be designed for vibration and fatigue using two million vibration cycles. All structural details shall be checked for fatigue resistance by applying governing fatigue loading, computing nominal stress ranges at the details and assuring that the stress ranges are less than the constant-amplitude fatigue limits for the particular details.

C. The design windload shall be the pressure of the wind based on a wind velocity of 100 m.p.h. with gusts up to 130% on the pole with all appurtenances installed as shown on the Contract Drawings, including but not limited to lowering ring, Luminaires, other equipment, pole and base.

D. Physical properties of poles shall be such that horizontal linear displacement due to the transverse load application is not greater than 5% of the structure height or the limitations set by vibration or fatigue analysis.

E. Structural design calculations of light pole assemblies, including anchor bolts, bases, and foundations shall be signed and sealed by a Professional Engineer licensed in the State of Texas. Submit to the Port of Houston Authority for approval.

1.4 QUALITY ASSURANCE

A. Companies manufacturing high mast lighting equipment, and components specified herein, and as shown on the Contract Drawings, shall have a minimum of five years of manufacturing experience and shall demonstrate prior experience on at least two projects involving complexities similar to those required under this Contract. Manufacturer’s tests on lighting fixtures shall be run in accordance with applicable Underwriters Laboratories (U.L.) Standard 1572

B. Electrical equipment items for which there are a nationally recognized standards shall be safety tested and bear the conformance labeling of the third party inspection authority, such as Underwriters Laboratories Inc. (UL), Electrical Testing Laboratory (ETL), Factory Mutual, or approved equal, certifying that the electrical equipment is listed as suitable for the purpose specified and shown on the Contract Drawings.

C. Electrical equipment shall be manufactured and installed in compliance with applicable articles of NFPA 70 and NFPA 101.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the manufacturer’s original, unopened, protective packaging. Wet or damp wrapping shall be removed, and disposed of, to prevent staining finish, and a substitute protective covering shall be fitted until the equipment is installed.

B. Store materials in manufacturer’s original protective packaging in a manner to prevent soiling and physical damage, prior to installation.
C. Maintain protective covering until installation is complete and remove such coverings as part of final cleanup.

D. Handle in a manner to prevent damage to finished surfaces. Touch up any damage to finishes to match adjacent surfaces.

E. Have lighting fixtures individually packed to permit ease of handling and to provide protection from damage during shipping, handling, and storage.

1.6 SPARE PARTS

A. Unless otherwise noted on the Contract Drawings, provide 10% (or minimum of 12) replacement lamps for each type of lamp installed.

B. Unless otherwise noted on the Contract Drawings, provide 5% (or minimum of 2) replacement ballasts for each type of ballast installed.

1.7 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Shop Drawings:

1. Manufacturer's established installation procedure manuals for each type of specified high mast light pole, lowering device (if applicable) and lighting fixture.

2. For each high mast type: Clearly illustrate assembly methods, luminary mounting hardware, detailed dimensions, anchor bolt size and templates, lowering device details, materials, finishes and electrical components.

3. For each lighting fixture type:
   a. Luminaires, ballast and lamp and optical assembly description and manufacturer's complete catalog number.
   b. Outline dimensions, support points EPA and unit weight.
   c. Luminaires schematic drawing and connection diagrams.
   d. Submit independent testing laboratory photometric report, and performance data in IESNA format. Complete test report with photometric curves.
   e. Zonal Lumen Summary Table.
   f. Input Watts.
   g. Luminaires Efficiency.
   h. Catalog data.
   i. Operation and maintenance data.
   j. Storage, handling, and installation recommendation.

4. For each ballast type: Submit manufacturer's data with ballast description, catalog number, lamp type, input voltage, input wattage, ballast factor, power factor, minimum starting temperature, operating temperature and wiring diagram.

C. Calculations:

1. Submit calculations verifying that total weight and Effective Projected Area (EPA) of the selected high mast with accessories and appurtenances do not exceed manufacturers Maximum Recommended Total Load. Structural design calculations of light poles assemblies, including anchor bolts, bases, and lowering devices (if applicable) shall be signed and sealed by a Professional Engineer licensed in the State of Texas.
2. Submit:
   a. Test results of the welds.
   b. Results of vibration and fatigue analysis.
   c. Structural computation of lowering device.
   d. If the splice design is based on the results of an independent outside entity, the complete test design shall be submitted.
   e. The design computations and drawings for any necessary dampers.
   f. Structural steel, reinforcing steel and concrete.
3. Submit computer generated lighting calculations for container terminal and wharf areas using independent testing laboratory photometric report of the fixtures used.

1.8 MEASUREMENT AND PAYMENT

   A. Payment for ‘High Mast Light Standard’ shall be on a unit price basis for Each unit assembly, including material, labor, and all other incidentals required, complete in place and accepted, excluding concrete pole foundation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

   A. Subject to compliance with requirements of this Section, provide high mast full cut-off lighting system of manufacturers listed as follows:

      1. Holophane.

   B. Other manufacturers will be considered for approval dependent upon extensive testing and field trials of the luminaires as described in the “Luminaires” Section below.

2.2 MATERIALS

   A. The High Mast Lighting System will be assembled by a manufacturer that is the single point of responsibility. This single entity will be responsible for submitting, providing and assembling all the components necessary for a complete and fully operational system.

   B. Unless otherwise noted on the Contract Drawings, materials for high mast lighting system shall be as specified below:

   C. Pole: Pole shaft shall consist of round and multi-sided tapered steel tubes. Pole sections over 12.5 inches in diameter shall be fabricated of ASTM A 572, Grade 65 material with minimum yield strength of $F_y = 65$ksi. Sections 12.5 inches and under in diameter shall be fabricated of ASTM A 595, Grade A steel modified to 55,000 psi minimum yield strength. Shaft shall be black powder coat over hot-dip galvanized after fabrication in accordance with ASTM A 123 and A 143. Anchor Base Plate: Steel plate fabricated from hot rolled weldable, low carbon steel conforming to ASTM A 572, Grade 50 shall be circumferentially welded to the pole top and bottom with full penetration butt weld with backup bar. The material shall possess a minimum yield strength of $F_y = 42$ ksi. Base Plate shall be hot-dip galvanizing after fabrication in accordance with ASTM A 123.
D. Anchor Bolt Assemblies: Fabricated from low carbon high strength steel alloy conforming to ASTM A615 Grade 75 possessing a minimum yield strength of $F_y = 75$ ksi. Each anchor bolt shall be provided with two (2) hex nuts and two (2) flat washers. The threaded end of each anchor bolt and each hex nut and washer shall be hot-dip galvanized at least 18 inches in accordance with ASTM A 153.

E. Bracket Arms: Fabricated from 2" schedule 40 pipe conforming to ASTM A 513.

F. Lighting Fixture Housings: Fabricated from die cast copper-free aluminum Alloy 360.1 with maximum 0.4% copper content.

2.3 MATERIAL CERTIFICATIONS

A. All material and products shall be produced in the United States of America. They shall be of the ASTM type. Mill certification shall be supplied for proof of compliance to this specification.

2.4 CONSTRUCTION FEATURES

A. General: The locations, sizes, and types of high mast floodlight pole assemblies are shown on the Contract Drawings.

B. Pole:

1. Shaft shall be tapered steel tubing. All shaft steel shall be full gauge without laminations. All sections of the shaft shall have a uniform taper from top to bottom and shall be full length longitudinally welded. Weld shall be as per AASHTO LTS-2, AWS D1.1 & D1.5, whichever will govern. All welds shall be inspected by methods described in AASTO LTS-2.

2. The overall height dimension as shown on the Contract Drawings shall be achieved by a combination of shop welding and/or field telescoping of one section onto another.

3. Pole shaft shall be secured to the foundation by base plate with anchor bolts.

4. All transverse welds and all base plate welds shall be 100 percent penetration. Longitudinal welds shall be 60 percent minimum penetration. The longitudinal weld in slip joint area shall be reinforced with a backup bar. Inspection shall consist of ultrasonic testing for all 100 percent penetration welds, visual and magnetic particle for all others.

5. Overall pole height shall not deviate from the specified height plus or minus 1 percent. Sweep and camber shall be maximum of 1/8 inch per 5 feet. Twist shall be a maximum of 10 degrees overall. The pole shall have a mounting flange or tenon on the topmost section for mounting a fixed luminary mounting ring or lowering device (if applicable.)

6. The bottom handhole shall be located no less than 6 inches above the base plate and shall be approximately 14 inches by 36 inches outside dimensions and shall have a suitable hinged, neoprene gasketed door and pad lock hasp. The handhole shall be reinforced by a 1/4 inch thick by 4-inch deep rim. Provide a minimum 5/16-inch thick support plate opposite the opening for mounting the winch (if applicable) and circuit breaker assemblies.

7. Two (2) additional handholes shall be located directly above the bottom handhole at 60 feet and 75 feet above the base place and shall be approximately 5 inches by 7 inches.
8. Welded splices or connections shall be in accordance with AWS D 1.1. In material where the yield point is increased by cold working or other physical means, the strength of the welds themselves shall be based upon the properties of the base metal prior to working.

9. A grounding lug shall be welded adjacent to the equipment handhole inside the pole, and shall be suitable for connection with #4/0 AWG bare copper cable as shown on the Contract Drawings.

10. Resistance of all joints in pole shall not exceed that of parent material.

11. Lightning rod assembly shall be bronze or copper and mounted on top of pole. Rods shall have a terminal as shown on the Contract Drawings. The lightning rod shall be connected to the luminary ring. The Pole Manufacturer, will mask all pole sections, so that there will be no powder coating on the outside of the top 6 inches of the section which will provide an adequate ground for the lightning rod when the poles are slipped together.

12. Each pole shall be suitably sized for the EPA of all equipment that will be mounted to it including the head frame and lowering ring with all luminaires, CCTV camera, and supporting devices actually installed.

13. Each anchor bolt shall be threaded as required, and have a 90 degree hook. Anchorage shall be based on the more stringent of AISC and AASHTO codes. Anchor bolts shall be provided with a full-size bolt circle template.

14. The foundation and anchorage system shall be designed for loads equal to, or greater than, the maximum loads that the pole is designed for. The geotechnical criteria shall be stated in order to determine the type of footing to be used (i.e. spread footing). The bottom of the pole structure shall be connected to an individual ground rod for lightning protection as well as to the site ground grid as indicated on the drawings.

15. Paint: Each pole shall be primed and powder coated in accordance with the requirements specified in Division 9 for Finishes. The final color for each pole shall be a flat black. Contractor shall touch-up all marred surfaces as required.

C. Ring Assembly:

1. Luminaires Ring Assembly:
   a. The ring shall be a fixed spoke type with a minimum 7-gauge A36 quality steel channel and shall be hot-dip galvanized. The ring shall have a sufficient quantity of 2" diameter galvanized steel pipe tenons for attachment of the luminaires.
   b. A lowering device can be provided to allow lowering of the luminaires ring for installation purposes at the Installer’s discretion, but is not required.

2. Wiring:
   a. Each ring shall be furnished with the necessary number and lengths of 7/c#10 Type "SO" electrical power cords. All cables shall be attached to the ring assembly at a NEMA Type IV weather-tight copper-free aluminum-wiring compartment through watertight cable connectors. A factory pre-wired 600V terminal block shall be provided in the wiring chamber. Each fixtures location shall have a three (3) pin female receptacle for wiring to terminal block. Each high mast pole shall be wired for two lighting circuits; one for two security lights and the second for 10 normal lights. Security circuits run to each pole shall be 3-phase, 4-wire tapped for one 1-phase, 480 volt, 2-wire supply to the two lights. Normal circuits run to each pole shall be 3-phase, 480-volt, 3-wire with the three phases supplying the ten normal lights. The security light circuit will be daisy chained to the adjacent poles but the normal circuit will be terminated at each pole.
The main power cable shall include three power conductors (one spare) for the security lighting and three power conductors for the normal lights. Other conductors may be required for other equipment as directed. A connector at the bottom of the cable shall be provided to accommodate all power connections.

b. Two (2) circuit breaker assemblies shall be mounted to the internal support plate to serve as disconnecting means.

c. Strain relief shall be provided at both ends of the main power cable with the use of the properly sized cable clamps. J-hooks for strain-relief are to be welded inside the pole 180 degrees from the two (2) upper handholes.

3. Manufacturer:
   a. Holophane HM120SPCL-3HH-FP/GV-SPR1230-CBASSY; Fixed Spoke Luminaires Ring with 120 foot Pole.
   b. Holophane HM85SPCL-3HH-FP/GV-SPR1230-CBASSY; Fixed Spoke Luminaires Ring with 85 foot Pole.

D. Luminaires (High Pressure Sodium Fixtures): Provide lighting fixture hardware in accordance with the lighting plan Drawings, Lighting Fixture Schedule, and this specification.

1. The high mast lighting luminaires shall be high mast cutoff type for container area lighting, as indicated on the Contract Drawings. All luminaires shall be pre-wired to the lowering device terminal box and shall include the specified HPS lamps on the Contract Drawings.

2. The luminaire shall be Holophane as described below. Other manufacturers are acceptable subject to approval of a step-by-step testing program to determine the proposed equipment will meet all of the specified requirements herein plus will have the exact photometric characteristics that will match the specified fixture. Field testing of other proposed luminaires may be a further requirement prior to approval.

3. The luminaire’s effective projected (EPA) area (without shields) shall not exceed 1.34 square feet. Fixture shall be UL listed for wet locations, 40°C ambient temperatures, and be CSA certified.

4. Housing shall be die cast from corrosion resistant alloy 360.1 low copper aluminum, primed with 100mg per square foot zinc phosphate and finished with 2 to 4 mil of TGIC polyester powder paint to match pole color.

5. The bracket arm clamp shall attach to a 51 mm (2") nominal schedule 40 pipe and allow for ±3° adjustment for leveling the luminaire.

6. The fixture shall pass a vibration fatigue test simulating "1-g" peak acceleration for 500 million cycles. A terminal block shall be provided to simplify wiring and provide positive electrical connections.

E. Luminaire Optical Assembly:

1. The optical assembly shall consist of highly specular enhanced aluminum panels hermetically sealed between a spun aluminum cover and an open ventilated borosilicate glass piece. The exposed smooth glass inner surface shall be continuously cleaned by the chimney effect of the flow through air and subject to no permanent deterioration. The lamp shall operate in the vertical position for maximum life and lumen maintenance.

2. Photometric Performance: The luminaire shall provide an ANSI/IES Type V Full Cutoff distribution. There shall be no glass bottom enclosure to scatter light above the horizon, to collect dirt or to reduce luminaire efficiency.
Where indicated on the drawing, a special low brightness reflector shall be installed to reduce direct glare. Where required, special light shields shall be installed to further reduce direct glare in specific areas of the container yard.

F. Manufacturer:
1. Holophane – “Advanced Optix” HMAOCP1HP48S9-PS-FD2

G. Ballasts:
1. Ballasts for HPS lamps shall be as specified herein. All ballast components shall be completely removable as a quick disconnectable unit for easy maintenance. Provide terminal blocks for wiring the ballast to the lamp and to the power supply.
2. The ballast shall be equipped with protective device that can sense an inoperative or missing lamp and shuts itself down.
3. Ballast shall be high power factor type. Fixtures shall be as indicated on Contract Drawings, or specified herein.
4. All ballast and matched capacitors shall be non-PCB and UL listed. Minimum power factor shall be 90 percent
5. Ballasts shall be of the regulated circuit design so that a plus or minus 10 percent variation in line voltage does not exceed plus or minus 13 percent lamp wattage regulation, and a reduction in line voltage of up to 25 percent does not extinguish the lamp.
6. Ballast core laminations shall be die-cast, highest quality steel, precision welded. Ballast coils shall be high temperature enameled magnet wire, precision wound, with Class H insulation. Each ballast shall be supplied with field-installed fuses in accordance with specific ballast manufacturer’s recommendation.
7. All ballasts for outdoor use shall be equipped with weatherproof leads, and shall be capable of starting and sustaining the lamp arc down to 0 degrees F.
8. Ballast noise level shall not exceed B sound rating
9. Ballasts for security lights shall incorporate an instant re-strike future.

H. High Pressure Sodium Lamps: Unless otherwise indicated, all high-pressure sodium lamps shall be compact envelope, clear type. Lamp Center Length (LCL) shall not exceed 7 inches and shall have the following initial lumen output and operating hours.

<table>
<thead>
<tr>
<th>Watts</th>
<th>Lumens</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>125,000</td>
<td>24,000</td>
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</table>

PART 3 EXECUTION

3.1 INSTALLATION

A. Foundation: Foundations shall be as shown on the Port of Houston Authority approved, signed and sealed design calculations submitted by the Contractor’s licensed Professional Engineer. Concrete shall be in accordance with Section 03 30 00.00 - Concrete Construction.

B. Excavation and Backfill: Excavation and backfill for foundation shall be in accordance with Section 31 - Excavation and Backfill for Utilities.
C. Install anchoring hardware in accordance with the manufacturer's instructions and the specified anchor bolt template. Maintain the additional projection of 10 inches required by paragraph 2.2C.

D. Dissimilar Metals:
   1. "Dissimilar metals" shall mean those metals, which are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data.
   2. Where dissimilar metals come in contact, paint the joint both inside, and out with approved coating to exclude moisture from the joint, or provide a suitable insulating barrier separating the metals.

E. Assemblies: Assemble luminaires in accordance with the manufacturer's instructions and as shown on the Contract Drawings. Provide and install any additional boxes, brackets, required for a complete installation.

3.2 INSPECTION

A. Upon completion of the installation, the lighting fixtures and lighting equipment shall be in operating order and condition and wiring shall be neatly arranged and the finish free from defects. At the time of final inspection, all fixtures shall be fully lamped and be complete with the required lenses, reflectors, shields and other components necessary for the specified functioning of the fixtures. All fixtures and equipment shall be clean and free from dust or paint spots. Any reflectors, glassware, or other parts broken prior to the final inspection shall be replaced.

3.3 ADJUSTMENTS

A. Luminaires shall be carefully aimed and shields adjusted in accordance with an approved computer-generated plot so as to provide a required footcandle distribution and light cutoff pattern. Adjust floodlights during the hours of darkness under the supervision of the Port Construction Representative. Notify the Port Construction Representative at least 48 hours before the aiming.

3.4 WARRANTY

A. Lighting System Manufacturer shall provide statement of warranty for all products provided.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
A. Subject to the General and Special Conditions, this Section includes specifications for arcproofing of low and medium voltage cables.

1.2 REFERENCES
A. American Society for Testing and Materials (ASTM):
   1. ASTM D 1000 - Test Method for Pressure Sensitive Adhesive Coated Tapes used for Electrical and Electronic Applications.
   3. ASTM D 2843 - Test Method for the Density of Smoke from the Burning or Decomposition of Plastics.
   5. OSHA - Occupation Safety and Health Administration.
B. Underwriters Laboratories (UL):
   1. UL 94V 0 - Tests for Flammability of Plastic Materials for Part in Devices and Appliances.

1.3 SUBMITTALS
A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Construction Representative. At the minimum, the following are required.
   1. Catalog cuts for Fire Resistant Tape, Glass Cloth Tape, and Cable Tags.
   2. Manufacturers' details of type of tests and test results.
   3. Conformance Certificate

1.4 QUALITY ASSURANCE
A. Code Regulations: All work shall be done in accordance with the applicable ordinances, codes and regulations adopted by the city in which the work is performed and which are
in effect at the time of signing the contract. The Contractor shall notify the Port Construction Representative of any conflicts therewith as specified and such conflict will be revised to comply with the Code or Ordinance. Such conflicts, if any, shall be settled before signing of the contract.

B. Protection: All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

C. Design and Performance Requirements: Arcproofing shall be furnished, installed, and reinstalled if required in accordance with this section.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s original, unopened, protective packaging.

B. Store material in original packaging in a manner to prevent soiling and physical damage prior to installation.

1.6 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fire Resistant Tape:

1. 3M Company.
2. Scotch 77.
3. Or approved substitution.

B. Glass Cloth Tape:

1. 3M Company.
2. Scotch 69.
3. Or approved substitution.

PART 3 EXECUTION

3.1 GENERAL

A. Inspect tape prior to installation. Defective tape shall be discarded.
3.2 INSTALLATION

A. Arcproofing shall be installed as follows:

1. Wires and cables shall be grouped by circuit and arcproofing applied over the group of cables comprising one circuit. Splices shall be arcproofed individually and the taping shall join with and be overlapped by the group taping.

2. Arcproofing shall be applied in two wrappings of half-lapped tape, bound with glass cloth tape applied at the ends of the fire resistant tape and at intervals not to exceed 24 inches along the entire length of the cables. The two wrappings shall be wrapped with opposing-lays.

3. Arcproofing shall be extended into the conduit opening or end bell of the raceway entering a handhole, manhole, or box.

4. Arcproofing tape shall be 1-1/2 inch wide where the diameter of the individual cable, or the circumscribed circle for the circuit group, is less than 1-3/4 inches. For larger diameters, the tape shall be 3 inches wide.

B. Identification of Wires and Cables:

1. Each wire and cable shall be identified by its circuit in all cabinets, boxes, manholes, handholes, and other enclosures, and at all terminal points

2. The circuit designations shall be as shown on the Contract Drawings. Tags shall be attached to wires and cables in such a manner as to be readily visible.

3. The tag ties shall be wrapped around all conductors comprising the circuit or feeder to be identified.

4. Wires and cables, which are arcproofed, shall be identified outside of the applied arcproofing.

3.3 ADJUSTMENTS

A. Prior to final inspection, arcproofing, which has been disturbed, for any reason, shall be reinstalled as soon as possible.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 26 60 02.00 Add – PROTECTIVE DEVICE COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes guidelines for the implementation of protective device settings and arc flash warning label installation.

1.2 REFERENCES

A. The following is a listing of publications referenced in this Section.

B. American National Standards Institute (ANSI)
   1. ANSI C 37.91 Protective Relay Applications of Power Transformers
   2. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
   3. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
   4. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
   5. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single Pole Air Switches, Fuse Disconnecting Switches and Accessories

C. Institute of Electrical and Electronics Engineers Inc. (IEEE)
   1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
   2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
   5. IEEE 1015 – Recommended Practice for Applying Low Voltage Circuit Breakers Used in Industrial and Commercial Power Systems

D. National Fire Protection Association (NFPA):
   1. NFPA 70 -- National Electrical Code
   2. NFPA 70E – Standard for Safety in the Workplace
1.3 QUALITY ASSURANCE

A. The protective device coordination study will be prepared by the Electrical Engineer of Record for the Port of Houston Authority and will be furnished to the Contractor for use in setting the overcurrent protective devices. Arc flash analysis will be a part of the protective device coordination study and labels will be provided for installation by Contractor.

B. The Contractor will secure the services of a qualified firm to perform setting of protective devices. The requirements include, but are not limited to, a minimum of five years experience in analyzing Time-current characteristic curves and CT ratios, and setting protective device relays.

1.4 SUBMITTALS

A. Contractor shall submit name of firm intended to perform the protective device settings. Submittal shall include the following information:

1. Company resume and list of references
2. List of protective device settings projects completed of similar magnitude
3. List of proposed personnel and their resumes designated to perform these services.

B. Contractor shall provide submittal for all overcurrent protection devices being provided under this contract with complete technical data sheets for use by the Electrical Engineer of Record in conducting the Protective Device Coordination Study. Data shall be submitted no less than 90 days after notice to proceed date in contract.

C. Submit protective device technical data in compliance with Section 26 28 0.00 – “Overcurrent Protective Devices.”

1.5 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work under this section. Include costs associated with this Section in unit pricing for items, which it is a component part.

1.6 DATA COLLECTION

A. Contractor shall furnish all technical data as required by the Electrical Engineer of Record. The Electrical Engineer performing the short-circuit protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Technical data to be furnished by the Contractor shall include, but not be limited to high voltage fuses, circuit breakers, vacuum loop switch circuit breakers, low voltage switchgear, fuses, motor control center breakers and/or fuses and all other overcurrent protection devices within the proposed distribution system.
C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Port of Houston, or Contractor.

PART 2 PRODUCTS

2.1 COORDINATION STUDY

A. Protective Device Coordination Settings: Implementation of protective device coordination settings shall be performed by the Contractor.

1. Protective device settings for proposed equipment shall be performed by the qualified firm according to the device setting data provided by the Port of Houston Authority. Existing device settings that require new settings because of the coordination analysis shall be performed by the qualified firm in accordance with setting data provided by the Port of Houston Authority.

B. Jacobs Engineering Group, Inc. will be responsible for determining, by analysis and modeling of the functional behavior and characteristics of the electrical power distribution system, the protective devices settings including all new devices installed under this contract and existing facility devices affected by the new devices. During the project construction, the Electrical Engineer of Record will verify the protective device settings based on the as-built conditions as established by the technical data provided by the Contractor. The Port of Houston Authority will submit for the qualified firm’s use calculations and settings for the project and terminal wide protective devices divided in two groups, project and existing terminal systems.

C. All specific equipment characteristics shall be provided in accordance with the results of the protective device coordination study and as provided to the Contractor by the Port of Houston Authority. The Contractor shall maintain a record of the protective device settings and update it to reflect any changes, which affect the setting requirements and provide to the Port of Houston Authority. Records shall include description, identification number, and Manufacturer’s model number of each device and shall include name of technician making setting adjustment and name of person witnessing setting adjustment. A certified copy of record shall be provided to the Port of Houston Authority on a weekly basis.

2.2 ARC FLASH HAZARD ANALYSIS

A. The arc flash analysis shall be performed in accordance with the requirements and recommendations of IEEE-1584-2002. Protection requirements shall be based on NFPA-70E-2004.
B. Jacobs Engineering Group, Inc. will be responsible for documenting and investigating, and evaluating and calculating the arc flash warning parameters and protective levels. Submitted documentation will include a detailed arc flash study and related values for electrical apparatus and equipment installed as part of this project. Revised arc flash warning parameters for existing equipment may result from the new equipment evaluation. During the project construction, the Electrical Engineer of Record will verify as-built arc flash conditions and warning parameters for project electrical equipment installed. A detailed report will be provided listing arc flash energy and hazard risk categories for all buses modeled. The Port of Houston Authority will provide printed arc flash warning labels to the Contractor for installation on all project related electrical equipment. Should revised warning labeling be required for existing electrical equipment, the Port of Houston Authority will install new labels.

2.3 ARC FLASH REPORT

A. The arc flash report developed by the Electrical Engineer of Record shall include:

1. Incident energy and flash protection boundary calculations
   a. Protective device clearing time
   b. Duration of arc
   c. Working distance
   d. Incident energy
   e. Hazard Risk Category

2. Recommended Protective Device Settings:

2.4 ARC FLASH WARNING LABELS

A. The Contractor shall be provided with two (2) sets of 3.5 inch by 5 inch thermal transfer type labels of high adhesion polyester for each work location analyzed. Contractor shall label in locations listed on labels.

B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the Port of Houston Authority and after any system changes, upgrades or modifications have been incorporated in the system.

C. The label shall include the following information, at a minimum:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance

D. Labels shall be machine printed, with no field markings.

E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600, 480, and applicable 208 volt panelboard, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low voltage switchboard, one arc flash label shall be provided.
4. For each switchgear, one flash label shall be provided.
5. For medium voltage switches one arc label shall be provided.

2.5 ARC FLASH TRAINING

A. The Contractor shall train the Port of Houston Authority’s qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 8 hours.) The training shall be certified for Continuing Education Units (CEU’s) by the International Association for continuing Education Training (IACET) or equivalent.

PART 3 EXECUTION – (NOT USED)

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 27 05 00.00 Add – COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes basic requirements specifically applicable to the work of Division 27 – “Communications.”

B. The Contractor shall furnish all equipment, materials, and labor for complete assembly and installation plus field testing and commissioning of the complete communications system as shown on the Drawings and stipulated in the Specifications.

C. The following is a brief list of work to be completed, as shown on plans.

1. A complete star topology physical fiber system including underground optical fiber cable installation with innerduct installation where required and including all applicable terminations, equipment, testing, and documentation.

2. A complete ring topology physical fiber system including underground optical fiber cable installation with innerduct installation where required and including all applicable terminations, equipment, testing, and documentation.

D. Communications Contractor Qualifications

1. Examination of site conditions shall be the responsibility of the Contractor: Contractors shall examine site as required prior to installation to determine any conditions affecting the scope of work. Contact Port Authority representative for arrangements. All systems and cabling are assumed working and in good condition unless Contractor documents exceptions.

2. Contractor shall call for all inspections required. Final payment of this contract will not be made until final inspections have been completed and all deficient items noted have been corrected.

3. The Contractor shall procure and maintain for the duration of this agreement insurance against claims for injuries to persons or damages to property, which may arise from, or in connection with, the performance of work hereunder by the Contractor, his agent’s representatives, employees, or sub-contractor. The Contractor shall pay the cost of such insurance. The Port Authority, its directors, officers, representatives, agents and employees, respectively, shall have no responsibility to the Contractor with respect to any insurance in accordance with the provisions set forth herein.

4. Contractor will adhere to the strict security requirements in place on PHA facilities, and will acquire all required identification (TWIC) for personnel that will need routine access to the secure areas of the Port’s facility.
5. Contractor must have a Registered Communications Distribution Designer (hereafter referred to as RCDD) on staff with Outside Plant expertise certification from BICSI. RCDD shall be directly involved in the planning, installation, and testing of communications cabling. RCDD shall approve all planning, installation, and testing documentation through stamp and signature. Identify the design experience of the proposed RCDD.

6. Contractor shall identify the qualifications of their technician. Contractor shall also identify the type(s) of certifications / testing that its technicians go through during employment with Contractor.

7. Installers: Only technicians certified by equipment manufacturer are approved.

8. The Contractor shall have a current ongoing safety training program and shall present published safety manuals for review where required by the Port of Houston Authority’s Representative.

1.2 RELATED SECTIONS

A. The requirements of GENERAL and SPECIAL CONDITIONS OF THE CONTRACT apply to this work.

1.3 REFERENCES

A. Applicable Standards: Comply with the latest editions of the following standards:

1. American IEEE Std 1100, Recommended Practice for Powering Grounding Sensitive Electronics
4. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.
5. ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR.
6. ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR.
8. TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14
9. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises
10. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
11. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunication Cabling and Components Standard
12. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
13. TIA/EIA-569-A-7, Commercial Building Standard for Telecommunications Pathways and Spaces
14. ANSI/CEA S83-596, Fiber Optic Premises Distribution Cable
15. ANSI/TIA/EIA-526-7.7: Optical Power Loss Measurements of Installed Single Mode Fiber Cable Plant-OFSTP-7
16. ANSI/TIA/EIA-526-14-A.: Optical Power Loss Measurements of Installed Multi Mode Fiber Cable Plant-OFSTP-14A
17. ANSI/TIA/EIA-569-A, Commercial Building Standards for Telecommunications Pathways and Spaces.
18. TIA/EIA-598-B, Optical Fiber Cable Color Coding
19. TIA-604-5-C, Intermateability Standard (FOCIS), Type MPO, FOCIS-5
20. TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure
21. J-STD-607, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
23. Port of Houston Authority Building Code
24. Other applicable Codes and Standards as referenced in other Specifications.
25. Comply with all current local, county, state, and federal regulations and codes in effect.
27. Equipment and materials shall conform to requirements of specification and to the criteria provided in data sheets for the project.

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this section. Include costs associated with this Section in lump sum pricing for bid items which it is a component part as shown on the Contract Drawings or located within the project limits of construction. Lump Sum price shall include coordination with PHA Construction Manager, Operations and Security, and utility companies or others (as needed).

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port of Houston Authority's Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish. This includes, but is not limited to, shop drawings of equipment, installation, termination, and splicing procedures, handling and storage instructions, dimensions and weights, and testing procedures and results.

C. Equipment submittals, acceptance-testing plans and the shop drawings shall be submitted as complete and contiguous packages. Partial or unmarked submittals will not be accepted for review. If submittal contains multiple sections, a Table of Contents and divider pages are required.

D. Clearly delineate (with highlighter, arrow, or underline) on each specification sheet, which model numbers, options, and configurations are being proposed for this project.

E. Each page in the submittal shall be numbered sequentially.

F. Submittals shall be provided in electronic Portable Document Format (PDF).

G. Indicate that all equipment, devices, and materials submitted are UL listed.

H. Indicate all substitutions where proposed equipment, devices, and materials do not meet requirements of plans and/or specifications.

I. Any items not submitted are not approved and shall not be manufactured, delivered to job site, or installed.

J. See Paragraph 3.5 – “Operation and Maintenance Manuals” for additional requirements.
1.6 QUALITY ASSURANCE

A. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. Field Inspection:

1. Communications work shall be inspected and approved by the Port of Houston Authority’s Representative.
2. Contractor shall give a minimum of three days’ notice to the Port of Houston Authority’s Representative that the installation is ready for inspection.
3. Concealed work shall be inspected before it is fully concealed:
   a. Fiber splices within splice closures
   b. Fiber terminations within patch panels
   c. Fiber inside manholes
   d. Innerducts
4. Communications equipment and materials shall be inspected upon arrival by the Port of Houston Authority’s Representative for compliance with specifications.

1.7 SITE CONDITIONS

A. Contractor shall take the following site conditions into consideration when fabricating, erecting, installing and wiring communications equipment under this contract:

1. Site Location: Bayport (Seabrook, Texas)
2. Site Type and Size: Industrial.
3. Site Elevation: Sea level.
4. Seismic Zone: Zone 0.
5. Wind Velocity: 100 mph sustained, with 3-second gusts of 130 mph.
6. Temperature, Min./Max.
   a. Coldest Winter Month: High: 60 degrees F; Low: 41 degrees F.
   b. Warmest Summer Month: High: 105 degrees F; Low: 73 degrees F.
   c. Lowest Expected: 11 degrees F.
   d. Highest Expected: 107 degrees F.
7. Rainfall:
   a. Annual: 45 inches.
   b. Design: 3.4 inches/hour, 8.4 inches/24 hours.
8. Design Relative Humidity: 98%.
9. Station Barometric Pressure:
   a. Average Annual: 29.5 inches Hg absolute.
1.8 GENERAL REQUIREMENTS AND RESPONSIBILITIES

A. General Contractor is solely responsible for coordinating all requirements of all equipment installed under this contract. Communications Subcontractor shall confirm this with General Contractor before bidding. Within 10 days of “Notice to Proceed,” the General Contractor shall appoint a person responsible for coordination of all equipment that is a part of this project and shall, at that time, notify the Port of Houston’s Representative in writing of that person’s name, telephone number, fax number, address, and all other pertinent information.

B. This specification section is an inherent part of all work performed on this project and its contents shall apply for all communications work. Contractor shall advise all Subcontractors and Vendors accordingly.

C. Warning: Electrical systems for this project have lethal voltages present. Contractor must work in the presence of a trained, experienced Electrician and with proper protective gear if working near exposed energized equipment. See specification for safety training requirements.

D. All work in manholes containing 15kV conductors, or near any medium voltage above ground, shall be directly supervised by a Master Electrician licensed by the State of Texas to ensure safety of all personnel.

E. Installation shall conform to most recent BICSI TDMM, NEC, International Building Code, and all other referenced Codes shown throughout the specification package.

F. Plans and diagrams are illustrative and may not contain all devices wiring and controls required to perform the function intended without reference to specifications.

G. Methods of work and devices described in all communications specification sections are intended to facilitate a properly constructed and operating communications system that meets Port Authority’s operational requirements and satisfies the requirements of local and national codes. The Port of Houston Authority’s Representative may approve methods or devices that vary from the requirements described in any particular specification if, in the Port of Houston Authority’s Representative’s judgment, the installation meets the intent of the Port of Houston Authority’s design criteria and, where the system performance meets the general requirements of the facility operation. This variance may be authorized during the submittal or inspection stage of the project, as the Port of Houston Authority Representative deems appropriate.

H. All equipment, innerducts, panels, and devices shall be installed in the most strict, professional manner to present a neat installation. Where a question arises concerning intent of method for installation or where details are not clear, Contractor is to contact the Port of Houston Authority’s Representative for clarification before proceeding with work. Any work not suitable or not installed in a professional manner will be modified to an installation acceptable to the Port of Houston Authority’s Representative at no additional cost.

I. Substitutions for equipment specified or shown on plans shall be as pre-approved prior to bidding unless specified or shown on plans as “or equal.” Where noted as “pre-approved,” indicates approval is required prior to bid acceptance.
J. The work shall include providing materials and equipment required for installation of a complete and functioning communications system as specified and as shown on the drawings.

K. All plans and specifications for this project are representative of the design intent and may not contain minute details associated with normally accepted communications system construction, as described in applicable codes or as described in manufacturer’s literature. Contractor shall provide all appurtenances normally associated with a particular equipment or device, and as required for a proper operating system. Some devices, equipment, or materials may appear in only one location on the plans or in the specifications. Each and every item shown or described is to be included for this project. No exceptions. All required circuits and devices necessary for intended operation are to be included without additional cost to Port Authority. Where discrepancies occur between various plans or specifications for this project and where clarification is not requested by Contractor prior to bidding, the most stringent request shall be included in the Contractors bid price. Electrical Sub-Contractor shall review all specifications for all trade disciplines with electrical requirements prior to bidding and shall include most stringent and higher cost requirements in bid price. No elements or requirements of the plans or specifications shall be omitted in Contractor's bid price unless specifically deleted in writing by the Port of Houston Authority. Failure to follow this specification requirement is at Contractor’s expense and at no additional cost to PHA or PHA's Representative.

L. Where work disrupts power and/or control to new or existing equipment, furnish temporary bypass circuits, as required, to maintain equipment operation.

M. Where work involves additions, modification, demolition, or renovations to existing facilities, Contractor shall remove, relocate, and extend existing installations to accommodate new construction.

This includes relocation of conduits, equipment, and materials that may obstruct placement of new equipment. Contractor shall field observe existing conditions prior to submitting a bid to become familiar with existing conditions and shall account for any relocations or extensions in bid. Refer to “As-Built” drawings and existing O&M Manuals. Failure to do so is at Contractors' risk and at no additional cost to Port Authority.

N. Where any equipment performance does not conform to specifications or, where in PHA’s opinion, parameters are out of tolerance or erratic in performance, the Contractor shall remove and replace equipment at no additional cost to the Port of Houston Authority.

O. Contractor shall provide the equipment necessary for locating all underground pipes, conduits, and structures before digging. All locations of intersection shall be properly staked and identified. Locating all underground lines is the sole responsibility of the Contractor and shall be at no additional cost to PHA. Any damage to underground utilities is the responsibility of the Contractor.

P. All equipment and devices shall be installed according to manufacturer’s instructions. Coordinate installation with manufacturer’s representative to assure correct installation methods have been applied. Prior to submittal review, Manufacturer’s Representative shall review plans and specifications and shall notify the Port of Houston Authority in writing where application shown on plans will not provide satisfactory and/or accurate performance. Failure to abide by this requirement shall be at Contractor’s risk and cost.
All equipment and materials shall be rated for the harsh Industrial, Electrical, and Mechanical environment in which installed and shall be warranted by manufacturer accordingly.

Q. All underground manholes and pull boxes to have cable racks and grounding. Cables and conductors are to be neatly dressed on racks around perimeter walls and properly secured to racks and tagged. Provide ample slack in cables and conductors. Where sufficient slack is not provided to route cables and conductors around perimeter, Contractor will be required to replace entire conductor length at no additional cost to the PHA- no splicing will be allowed to meet this provision.

PART 2  PRODUCTS

2.1 COMPONENT DESIGN

A. Components utilized in the construction of the material or equipment shall be of the latest proven design, new and in current production. Do not use obsolete components or components to be phased out of production.

2.2 FACTORY INSPECTION

A. Provide free access with prior notice for the Port of Houston Authority or Port of Houston Authority's Representative at all times to the shop where the material or equipment is being fabricated or tested. Provide reasonable facilities for inspection, witnessing tests, and examining records. Give 7-days notice prior to starting tests that are scheduled for factory inspection.

2.3 TEST EQUIPMENT

A. The Contractor is responsible for furnishing all test equipment required to test the system in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment of accuracy better than the parameters to be tested.

B. The test equipment list shall be furnished as a part of the submittal, to include the make and model number of the following types of equipment as a minimum:

1. Optical Power Meter
2. Optical Time Domain Reflectometer

C. Readiness: Keep all test equipment at hand and maintain in calibrated condition at jobsite as required for routine and performance testing of this work.

D. Calibration: All test equipment shall be maintained and calibrated on regular intervals (every six (6) months). Calibration shall be in accordance with the Manufacturer's recommendations and in compliance with ISO 9001:2000 Standards.
PART 3 EXECUTION

3.1 PREPARATION

A. Verify dimensions and ratings of equipment and materials to ensure proper fit and performance.

3.2 INSTALLATION

A. Install equipment and materials in accordance with the Drawings and manufacturer's written instructions. If field conditions necessitate changes in installation, obtain approval from the Port of Houston Authority's Representative.

3.3 TESTING AND COMMISSIONING

A. All testing to be performed in compliance with NETA Acceptance Testing Specifications and Section 27 13 00.00 Communications Backbone Cabling.

B. Test the communication system to specification requirements and to demonstrate correct installation and operation of equipment.

3.4 TRAINING

A. Provide training sessions at the construction site for the number of assigned personnel, for one (1), eight (8) hour day or as required by the Port of Houston Authority's Representative. This requirement is in addition to specific requirements in other specification sections covering equipment.

B. The training sessions shall be conducted by a manufacturer's qualified Technicians and representative near the end of construction when all equipment is in operating condition. The training program shall consist of the instruction on the operation of the equipment assemblies, major components, and associated documentation.

C. The training program shall consist of instructions for start-up, testing, operating, and troubleshooting of the specified equipment. Full documentation and software shall be introduced and provided at the sessions as follows;

   1. Training Manual
   2. Standard Manual for Operation and Maintenance, Testing and Troubleshooting

3.5 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The Contractor shall submit the O&M manual in electronic Portable Document Format (PDF) for review and approval by the Port of Houston Authority Representative. Upon approval of the O&M manual, the Contractor shall submit six (6) complete hard copy sets of approved O&M manuals bound in a three –ring binder and provide in PDF on CD with printed label.

B. The manuals shall include wiring diagrams and operating and maintenance literature for all components provided under Division 27 – “Communications.” The submitted literature shall be in sufficient detail to facilitate the operation, removal, and installation,
programming and configuration, adjustment, calibration, testing and maintenance of each components and/or instrument. The O&M manual shall be professionally composed and complied and shall not be an assembly of cut sheets. Each page of the O&M manual shall be numbered sequentially. A Table of Contents and divider sections are required. The Port of Houston Authority shall have sole discretion of acceptance of O&M manual contents and composition.

C. The contents of the O&M manuals shall be generally organized as follows:

1. System Hardware/Installation
2. System Software (where applicable)
3. Operation (Step-by-Step Procedures)
4. Wiring Diagrams
5. Maintenance and Troubleshooting
6. Warranty Certificates

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 27 05 43.00 Add – INNERDUCT CONDUIT

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for innerduct conduit.

B. The following specification details the requirements for HDPE innerduct as manufactured for the purpose of security, protection, and identification of fiber optic or coaxial cable networks.

1.2  REFERENCES


1. NEC Article 346-15.

B. Underwriters' Laboratories (UL): UL-2024

C. Port of Houston Authority Electrical Code.

1.3  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port of Houston Authority’s Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port of Houston Authority’s Representative. At the minimum, the following are required:

1. Manufacturer’s cut sheets, catalog data, and sizes.
2. Installation, terminating and splicing procedure.
3. Instruction for handling and storage.
6. Conformance certificate.
1.4 QUALITY ASSURANCE

A. Protection: All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. All innerduct shall be circular and of uniform cross section to the dimensions in accordance with ASTM D3035 and F2160.

C. Innerduct shall be a continuous length with a low friction internal surface containing no welds or joints, coiled on a reel.

1.5 DELIVERY STORAGE AND HANDLING

A. Store Innerduct above ground on racks to prevent corrosion and entrance of debris.

B. Protect plastic conduit from sunlight.

1.6 MEASUREMENT AND PAYMENT

A. Payment for “Innerduct Conduit” shall be on a lump sum basis for all material, labor, and all other incidentals required, complete in place and accepted. Lump Sum price shall include coordination with PHA Construction Manager, Operations and Security, and utility companies or others (as needed).

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Innerduct Conduit:
   1. Carlon
   2. Blue Diamond Industries
   3. Or approved equal

2.2 MATERIALS AND EQUIPMENT

A. Material:
   1. High Density Polyethylene (HDPE)
   2. Ribbed, corrugated or smooth wall
   3. Commercial-grade Nylon pull string
   4. Multiple color selections
PART 3 EXECUTION

3.1 GENERAL

A. Ensure that the conduit system to be installed is sized properly for the innerduct requirements.

B. Verify the actual physical conduit route from the conduit plan drawings and prepare the conduit support system. All spare innerducts shall include a commercial-grade Nylon pull string.

C. Verify the equipment locations to which the conduit will be connected and determine detail requirements for connections.

D. The Installer should use appropriate instrumentation to insure the maximum pull rating is not exceeded, when pulling Innerduct through conduit.

E. Pull continuous length of innerduct from end to end of conduit runs. Where possible use proper couplings for joining connections in manholes. Coupled connectors not allowed in conduit run.

F. Support innerduct at minimum 18-inch intervals where not in conduit.

G. Do not install crushed or damaged innerduct.

H. Provide means of drainage at low position in manholes.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL
SECTION 27 05 53.00 Add – IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for labeling and identification procedures for communications systems equipment and cabling.

1.2 RELATED SECTIONS

A. The requirements of GENERAL and SPECIAL CONDITIONS OF THE CONTRACT apply to this work.

1.3 REFERENCES

A. ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
B. UL 969 - Standard for Marking and Labeling Systems
D. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM)
E. Local, county, state and federal regulations and codes in effect as of date of purchase.
F. Port of Houston Authority Electrical Code.

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this section. Include costs associated with this Section in lump sum pricing for items which it is a component part as shown on Contract Drawings or located within the project limits of construction.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. The Contractor shall submit to the Port of Houston Authority’s Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the contractor proposes to furnish, shop drawings of equipment, and details as may be required by the Port of Houston Authority’s Representative. At the minimum, the following are required:

1. Manufacturer's cut sheets, catalog data, and sizes.
2. Installation procedure.
3. Communication System Identification Scheme conforming to PHA requirements.
4. Master list of label titles including full description of each label.

C. With each submittal include a copy of the applicable specification(s) page(s) for the item submitted and mark “Complies” or “Non-Compliance” or “Exception” adjacent to the applicable paragraph. Identify applicable drawing sheet number and specification section on front of each submittal cover.

D. Equipment submittals shall be submitted as complete and contiguous packages. Partial or unmarked submittals will not be accepted for review.

E. Clearly delineate (with highlighter, arrow, or underline) on each specification sheet, which model numbers, options, and configurations are being proposed for this project.

F. Indicate all substitutions where proposed equipment, devices, and material do not meet requirements of plans and/or specifications.

G. Any items not submitted are not approved and shall not be manufactured, delivered to job site, or installed. Contractor assumes all risk and cost associated with such items if rejected by the PHA’s representative.

H. The Contractor shall submit shop drawings and/or product data electronically in Portable Document Format (PDF) document exchange format. Each electronic document submittal shall include a letter of transmittal containing the project name, date, name of Contractor, list of documents submitted including titles and descriptions, requests for any review of departures from the contract requirements and any other pertinent information.

I. Contractor shall submit communication system identification scheme submittal which identifies specific identification terminology system for all fiber and copper patch cables, outdoor fiber cables, manholes, conduit, patch panels, switches, and additional hardware per PHA’s requirements. This system shall logically identify site specific facilities and provide routing information consistent at opposing ends.

1.6 QUALITY ASSURANCE

A. Protection: All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workers. Work shall be properly protected to prevent obstruction or damage. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

B. All products of similar classification shall be identical. This requirement includes equipment, assemblies, parts, and components.
C. Products submitted and utilized during the construction of this project shall be appropriate for the environment in which they are installed, including variations in temperature, humidity, and vibration.

1.7 HANDLING AND STORAGE

A. Store identification materials in a location to preserve adhesion properties and prevent deterioration of products prior to installation.

B. Materials shall be stored in a manner consistent with manufacturer’s recommendations.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Labels and/or labeling system:
   1. Brady
   2. Dymo
   3. Or approved equal

2.2 GENERAL REQUIREMENTS

A. All telecommunication components, areas, and cables shall be labeled, including but not limited to:
   1. Fiber cables
   2. Metallic cable
   3. Ground points
   4. Cross-connect fields
   5. Exterior enclosures
   6. Conduit ends (pathways)
   7. Pull boxes and junction boxes
   8. Equipment racks and cabinets
   9. Fiber patch panels
   10. Maintenance holes
   11. Cables in maintenance holes and pull boxes
   12. Patch cables/jumpers

B. Pathways are defined but not limited to; any conduit, innerduct, underground duct bank, wiring troughs, pull boxes, and any wiring systems used to enclose cabling of any type.


D. All label material shall be suitable for intended usage and environment, meeting the legibility, defacement and general exposure requirements listed in UL 969 for indoor and outdoor use. Where insert labels are used the insert label shall be covered with clear cover and securely held in place.
E. Interior labeling: printer shall be of the thermal transfer type capable of printing self
laminating labels of various size up to and including 1.5" by 1.5" printable area with a 4.5"
self laminating tail. No non-self-laminating labels shall be approved.

F. All labels shall be permanent, i.e. will not fade, peel, or deteriorate due to environment or
time.

G. Handwritten labels are not acceptable.

2.3 CONDUITS AND PATHWAYS

A. Conduits: General-purpose label designed for powdered coated surfaces with an ultra-
aggressive adhesive, trade name, “Mondo Bondo” (Brady). Label size shall be
appropriate for the conduit size. Font size shall be easily visible from the finished floor.

B. Innerduct: Polyethylene general-purpose tagging material, Brady part number PTL-12-
109 (.75 X 3.00) used with an R4310 ribbon. This tag shall be attached using tie wraps.

C. Junction boxes: General-purpose label designed for powdered coated surfaces with an
ultra-aggressive adhesive, trade name, "Mondo Bondo", Brady part number PTL-43-483
(1.90 X continuous) used with an R6010 ribbon. Font size shall be easily visible from the
finished floor.

2.4 Backbone and Horizontal Cable and Terminations

A. Fiber termination hardware (cover): General purpose label designed for powdered coated
surfaces, trade name, “Mondo Bondo”, Brady part number PTL-42-483 (1.00 X
continuous) used with an R6010 ribbon.

B. Fiber termination hardware (designation strip): Thermal transfer printable label with a
permanent acrylic adhesive, Brady part number PTL-10-423 (.75 X .25) used with an
R6010 ribbon.

C. Patch panels: Gloss white film with a permanent acrylic based adhesive, Brady part
number PTL-39-422 (.375 X .60) used with an R6010 ribbon.

D. Inside and outside plant fiber cables: Permanent acrylic adhesive, self-laminating vinyl
wire and cable identification, Brady part number PTL-33-427 (1.50 X 4.00 X1.00) used
with an R4310 ribbon.

2.5 Equipment Racks and Cabinets

A. General purpose label designed for powdered coated surfaces.

B. Basis of Design: Trade name, “Mondo Bondo”, Brady part number PTL-42-483 (1.00 X
continuous) used with an R6010 ribbon.
PART 3  EXECUTION

3.1  CONDUITS AND JUNCTION/ PULL BOXES

A. All conduits, innerduct, junction boxes, gutters and pull boxes shall be labeled.

B. Conduits shall be labeled with the word “communications” and the conduit’s origination room number and destination room number. Permanent room identifiers shall be used.

C. Label conduit every 50 feet, at each wall and floor penetration and at each conduit termination, such as outlet boxes, pull boxes, and junction boxes, or as otherwise specified in other Sections.

D. Junction boxes, gutters and pull boxes shall be labeled with identification name or number as determined by Contractor and submitted for approval.

E. Labels on conduits, junction boxes, gutters and pull boxes shall be machine-generated and easily visible from the finished floor.

3.2  FIBER TERMINATIONS

A. Label cable terminations on designation strips.

B. Label all cable at each terminating point.

C. Labels shall be self-adhesive and machine generated. Handwritten labels are not acceptable.

D. Cable identification numbers shall not be duplicated.

E. Three copies of a cable record document containing the cable information required on the cable label shall be delivered to PHA IT.

3.3  EQUIPMENT RACKS AND CABINETS

A. All racks and cabinets shall be properly labeled with permanent typewritten labels, easily visible from finished floor.

3.4  CLEANING

A. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.

3.5  ACCEPTANCE

A. Once all work has been completed and the Port of Houston Authority’s Representative is satisfied that all work has been completed in accordance with contract documents, the Port of Houston Authority’s Representative will notify Contractor in writing of formal acceptance of the system.
B. Acceptance shall be subject to completion of all work and submittal and approval of full documentation as described above.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 27 13 00.00 Add – COMMUNICATIONS BACKBONE CABLEING

PART 1 GENERAL

1.0 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specification for communications backbone cabling.

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. Single mode optical fiber cabling.
3. Cable connecting hardware, patch panels, and cross-connects.
5. Tests and inspections.

1.2 DEFINITIONS

A. ANSI: American National Standards Institute
C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
D. EMI: Electromagnetic interference.
E. IDC: Insulation displacement connector.
F. LAN: Local area network.
G. OLTS: Optical Loss Test Sets
H. OTDR: Optical Time-Domain Reflectometer
I. RCDD: Registered Communications Distribution Designer.
J. UTP: Unshielded twisted pair.
1.3 BACKBONE CABLELING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms and individual high mast light standard locations, and communications path around the entire Container Terminal for future communication needs. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in ANSI/TIA -568-C, when tested according to test procedures of this standard.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format approved by the Port of Houston Authority’s Representative.
   2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   3. Cabling administration drawings and printouts.
   4. Wiring diagrams to show typical wiring schematics including the following:
      b. Patch panels.
      c. Patch cords.
   5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
   6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
      a. Vertical and horizontal offsets and transitions.
      b. Clearances for access above and to side of cable trays.
      c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
      d. Load calculations to show dead and live loads as not exceeding manufacturer’s rating for tray and its support elements.

C. Qualification Data: For Installer qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.
1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD with BICSI seal and signature.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician who shall be present at all times when Work of this Section is performed at Project site.

B. Testing Qualifications:

1. Testing Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.


1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Submit test data to the Port of Houston Authority’s Representative and include the record in maintenance data.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Port of Houston Authority’s telecommunications and LAN equipment and service suppliers as well as PHA IT personnel.

1.10 SOFTWARE SERVICE AGREEMENT – (NOT APPLICABLE)
1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fiber Patch-Panel Units: Refer to schedule on plans.
2. Fiber Splice Closures: Refer to schedule on plans.

1.12 MEASUREMENT AND PAYMENT

A. Payment for “Fiber Optic Communication System” shall be on a lump sum basis for all material, labor, and all other incidentals required, complete in place and accepted. Lump Sum price shall include coordination with PHA Construction Manager, Operations and Security, and utility companies or others (as needed).

B. Payment for “Fiber Optic System Testing” shall be on a lump sum basis for all material, labor, and all other incidentals required, complete in place and accepted. Lump Sum price shall include coordination with PHA Construction Manager, Operations and Security, and utility companies or others (as needed).

PART 2 PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Cable Trays: Supplied in separate contract.

2.2 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Corning Cable Systems.
2. Or pre-approved equal.

B. Description: Single mode, all-dielectric, loose tube, gel-free optical fiber cable. Refer to fiber optic cable schedule.

1. Comply with ICEA S-87-640 for mechanical properties.
3. Comply with TIA/EIA-492CAAAA for detailed specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70.
C. Jacket:
   1. Jacket Color: Match existing single mode cable at the terminal.
   2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
   3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.3 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers:
   1. Corning Cable Systems.
   2. Or pre-approved equal.

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
   1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in lengths as required. Refer to material schedule on plans for further information on equipment requirements.

D. Cable Connecting Hardware:
   2. Quick-connect, duplex, Type LC/UPC connectors. Insertion loss not more than 0.75 dB.

2.4 GROUNDING

A. Comply with requirements in Section 26 05 26 - "Grounding & Bonding" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to ANSI/TIA-568-C.

B. Factory test UTP cables according to ANSI/TIA-568-C.

C. Factory test single mode optical fiber cables according to TIA/EIA-526-7 and ANSI/TIA-568-C.
D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

2.7 CLOSET CONNECTOR HOUSINGS

A. Manufacturer:
   1. Corning
   2. Or approved equal

B. Closet Connector Housing:
   1. Provide interconnect or cross-connect between outside plant, riser or distribution cables and opto-electronics by use of cable systems closet connector housings.
   2. Units shall be designed for rack mounting in 19-inch racks, or optional 23-inch equipment racks with 1.75 inch EIA hole spacing. Provide 3-rack space (six (6) panels) or 4 rack (twelve (12) panels) units with open top at front of housing to facilitate jumper routing in conjunction with a closet jumper management panel.
   3. Provide connector housings with connector panels for single mode applications in 6, 8, 12, and 24-fiber configuration, as required.
   4. Housings shall include multiple locations for jumper egress, and universal cable clamps for cable strain relief.
   5. Housing shall have a removable, polycarbonate-tinted front door with lock. Optional top and side covers shall be available where required.

C. Equipment Description:
   1. Model CCH-04U: Closet Connector Housing (CCH); accepting up to twelve (12) CCH panels or modules; with blank panels and hardware to strain-relieve one (1) cable with the Universal Cable Clamp (UCC) or up to five (5) 0.4 inch or smaller cables with the patented UCC insert. Dimensions (H x W x D): 7 inches x 17 inches x 12 inches. Shipping Weight: 8 pounds.
   2. Model CCH-04U: CCH-04U preloaded with seventy-two (72) LC duplex adapters (twelve (12) CCH panels, 144F), single mode fiber, composite insert, composite housing.
   3. Accessories:
      a. CJP-01U: Closet Jumper Management Panel; to provide jumper management in a 1.75-inch rack space.
      b. CJP-02U: Closet Jumper Management Panel; to provide jumper management in a 3.5-inch rack space.
      c. CCH1-LABEL-CARD-20: Replacement Label Kit for the CCH (3-rack space housing); containing twenty (20) labels.
      d. CCH4-LABEL-CARD-20: Replacement Label Kit for the CCH (4-rack space housing); containing twenty (20) labels.
      e. CCH-UCC-KIT: One (1) Bracket and two (2) Universal Cable Clamps (UCC’s); each housing to be shipped with one (1) bracket and two (2) UCC’s; an additional bracket and UCC shall be added; two (2) multicable grommets to be included that accept up to five (5) 0.4 in diameter cables.
      f. HDWR-LOCK-KIT: Lock Kit for front door of housing; containing one (1) lock with two (2) keys.
      g. CCH-TOP-CVR: Patch Field Cover to cover top opening in CCH-04U housings.
h. FDC-CABLE-GRND: Armored Cable Grounding Kit containing armored grounding clip and ground strap.
i. CCH-04U-SIDEPNL: Side Panels to enclose CCH-04U housing; kit shall include two (2) panels.
j. CDF-04U-23-BKT: 23 inch Mounting Brackets for the CCH-04U.
k. CDF-04U-24-BKT: 24 inch Mounting Brackets for the CCH-04U.
l. CPP-04U-RECESS-KIT: Flush Mount Brackets for the CCH-04U.

2.8 SPLICE CLOSURE

A. Manufacturer:
   1. Corning
   2. Or approved equal

B. Splice Closure:
   1. Provide manufacturer's wall-mount hardware to mount on the walls of manholes or pole-mount hardware as required in the plans. Mounting methods not approved by the manufacturer will not be accepted.
   2. Provide splice closure sized for the required number of fibers, feed through cables, and distribution cables as shown on plans.
   3. Provide splice trays for the required number of fibers as shown on plans.
   4. Provide flash test air valve and submit test results to prove proper sealing of the closure.

PART 3 EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by others.

3.2 WIRING METHODS


B. Wiring Method: Conceal conductors in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in specifications and on plans. Drawings indicate general arrangement of pathways and fittings.
C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Section 27 05 43.00 – “Innerduct Conduit” for installation of innerduct conduit within rigid conduit.

E. Comply with requirements in Section 26 05 36 – “Non-Metallic Cable Tray”.

F. Pathway Installation in Communications Equipment Rooms:
   1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
   2. Install cable trays to route cables if conduits cannot be located in these positions.
   3. Secure conduits to backboard when entering room from overhead.
   4. Extend conduits 3 inches (76 mm) above finished floor.
   5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Provided by others under separate contract.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   1. Comply with ANSI/TIA -568-C.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
   4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals. Where cable is shown supported on cable tray, refer to Section 26 05 36 – “Non-Metallic Cable Tray” for requirements.
   5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
   6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
   7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   8. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
   9. In the communications equipment room, install a service loop on each end of cable with a length adequate to accommodate future termination in respective patch panel or enclosure.
   10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable". Monitor cable pull tensions.
C. Optical Fiber Cable Installation:

1. Comply with ANSI/TIA -568-C.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
3. Fiber Optic Cable (FOC) shall be installed per the manufacturer specifications. Excessive pulling tensions or excessively short bending radii must be avoided. The maximum pulling tension is 600 pounds(f) and the minimum bending radius is twenty times (20X) the outside diameter of the cable.
4. A breakaway swivel and slip clutch capstan winch, displaying the dynamometer reading at all times, shall be used during FOC installation. The Contractor shall ensure pulling equipment is in good condition and has been properly calibrated. The Contractor shall maintain current records at all times and provide copies upon request.
5. Industry approved cable lubrication shall be used as needed during the FOC placement operation.
6. Slack coil requirements at the cable ends are 100 feet at the computer room end and a minimum of 20 feet at the Guardhouse end. Each handhole will have slack loops of minimum of 20 feet; this includes the pull box behind the new guardhouse. The cable ends shall be sealed watertight at all times to prevent water from entering the cable. Slack loops shall be coiled neatly and secured properly. The reels shall be supervised at all times during cable installation.

D. Post-Installation Testing:

1. Upon completion of fiber optic cable installation, the Contractor shall verify continuity and splice locations between the end points by testing each fiber unidirectional with an OTDR at 1310 nm and 1550 nm. If any damage is observed, the Contractor shall remove and replace the entire section of cable between end points and shall bear all associated costs. The Contractor shall prepare a written report, including test data, at the completion of all FOC testing.
2. The Contractor shall also verify light loss levels by testing each fiber unidirectional with an OLTS at 1310 nm and 1550 nm. If excessive light loss is present, the Contractor shall remove and replace the entire section of cable between end points and shall bear all associated costs. The Contractor shall prepare a written report, including test data, at the completion of all FOC testing.
3. The Contractor shall ensure testing equipment (OTDR and OLTS) are in good condition and have been properly calibrated. The Contractor shall maintain current records at all times and provide calibration certificates for all devices used.

E. Group connecting hardware for cables into separate logical fields.

3.5 FIRESTOPPING

B. Comply with BICSI TDMM, “Firestopping Systems” Article.
3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 16195 – “Electrical Identification.”

1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Cable Schedule: Install in a prominent location in each equipment room and enclosure. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project to the Port of Houston Authority’s Representative.

C. Cabling Administration Drawings: Show system routing plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, and terminal hardware and positions.

D. Cable and Wire Identification: Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

E. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA -568-C.
2. Visually inspect cable placement, cable termination, equipment and patch cords, and labeling of all components.

3. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA -568-C. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Horizontal and single mode backbone link measurements: Test at 1310/1550 nm in one direction according to TIA/EIA-526-7, Method B, One Reference Jumper.
      2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in ANSI/TIA -568-C.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports. Submit test results to the Port of Houston Authority’s Representative for review.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes geotextile in applications such as pavement course separation, soil separation layer beneath rip rap, pipe embedment wrap, around the exterior of a tunnel liner, around the foundations of pipeline structures, and slope stabilization.

1.2 RELATED SECTIONS

A. 31 23 35.00 – Excavation and Backfill for Utilities

B. 31 37 16.13 – Riprap

1.3 REFERENCES


B. American Society for Testing and Materials (ASTM)

1. ASTM D 3776 - Standard Test Methods for Mass per Unit Area (Weight) of Woven Fabric.
3. ASTM D 3787 - Test Methods for Bursting Strength of Knitted Good Constant Rate of Traverse (CRT Ball Burst Test).

C. Corps of Engineers

1. COE CW - 02215 - Geotextiles Used As Filters.
1.4 MEASUREMENT AND PAYMENT

A. Woven geotextile for use as a layer beneath pavement drainage layer will be paid for at the unit price per Square Yard for fabric complete in place and accepted. Payment shall be based on accepted, in-place geotextile to the dimensions indicated on the plans.

No payment shall be made for Woven Geotextile for use as a layer beneath riprap for drainage swales described under Section 31 37 16.13 – Riprap.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit the standard manufacturer's catalog sheets, manufacturer's sampling and test data, and other pertinent information, for approval, prior to installation.

C. Submit installation methods, as a part of the work plan for tunneling or for excavation and backfill for utilities. Obtain approval from Chief Engineer for filter fabric material and the proposed installation method prior to use of the filter fabric.

D. Contractor shall provide a 12-inch x 12-inch sample of the geotextile fabric used during the course of the project to the Chief Engineer for testing.

PART 2 PRODUCTS

2.1 GEOTEXTILE

A. Provide a geotextile (filter fabric) designed for use in geotechnical applications. The filter fabric shall provide a permeable layer or media while retaining the soil matrix.

B. Use fabric, which meets the physical requirements for Class A subsurface drainage installation conditions as defined in AASHTO M 288 and as specified in Paragraph 2.2, Properties.

C. Provide geotextile of woven monofilament material as a layer beneath riprap. Woven slit film geotextiles or nonwoven geotextiles are not acceptable.

2.2 PROPERTIES

A. Material: non-biodegradable, fabric consisting only of continuous chain polymer filaments or yarns, at least 85 percent by weight polyolefins, polyesters or polyamide, formed into a dimensionally stable network.

B. Chemical Resistance: Inert to commonly encountered chemicals and hydrocarbons over a pH range of 3 to 12.

C. Physical Resistance: Resistant to mildew and rot, ultraviolet light exposure, insects and rodents.
D. Minimum Test Values:

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<th>Property</th>
<th>Value (Min.)</th>
<th>Test Method</th>
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<td>Trapezoidal Tear Strength</td>
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<td>ASTM D 4533</td>
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<td>Puncture Strength</td>
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</table>

PART 3  EXECUTION

3.1 LINE WORK

A. The use of the geotextile with backfill for utilities shall conform to Section 31 23 35.00 - Excavation and Backfill for Utilities. For pipe embedment wrap applications, place geotextile to prevent particle migration from the in-situ soil into open-graded embedment materials or drainage layers there will be no separate pay for geotextile in utility installations.

3.2 PAVEMENT COURSE SEPARATION

A. Use geotextile to prevent the migration of soil fines into the pavement drainage layer. Select a geotextile specified for pavement course separation that also meets the above requirements.

3.3 TUNNEL WORK

A. Use geotextile outside of a tunnel primary liner to prevent the migration of soil fines into the excavated tunnel resulting in voids or settlement. Select a geotextile meeting tunnel liner design requirements and installation conditions.

3.4 SLOPE STABILIZATION

A. For slope stabilization applications, geotextile fabric shall be placed on the prepared slope face, in intimate contact with the subgrade, and free of folds or wrinkles, prior to the placement of erosion control devices such as cellular concrete mat and riprap. The geotextile shall not be walked on or disturbed. The geotextile filter fabric shall be placed so that the upstream strip of fabric overlaps the downstream strip. The longitudinal and transverse joints shall be overlapped at least two (2) feet. The geotextile shall extend at least one foot beyond the top and bottom revetment termination points.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 23 13.00 Add - EXCAVATING AND GRADING FOR PAVED AREAS
AND RAILROADS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes all excavating including all clearing and grubbing, scarifying, ditch siltation removal, all material placement including filling, backfilling, borrow fill, grading and fine grading, stockpiling, compacting of soils for preparation of subgrade for pavement and railroad trackage and for preparation of other soil areas designated on the Drawings or in the Technical Specifications; however, structural excavation, drilled shafts, lime stabilization of subgrade and trenching for sewers, water lines and other underground utilities are not included in these Technical Specifications.

B. Preparation of subgrade and other designated areas shall include the excavation, loading, hauling, dumping and spreading of soil; undercutting to remove unstable soil areas; compacting existing soil surfaces, and bottom of excavated areas to receive fills and backfills; compacting excavated areas for subgrade; placing and compacting soil in fills and backfills; pumping to keep excavated areas dry; finish grading for subgrades and other designated soil areas; disposing of unsuitable and excess excavated material; and all work incidental to such work, all as shown on the Drawings and specified herein.

C. Cut and Fill items under this specification require a verification survey of existing ground surface for establishing earthwork quantities within the scope of the Project as described in 01 50 00.00 Temporary Facilities and Controls.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, Payment for Excavation and Grading including All Cut and Fill items, Clearing and Grubbing, Scarifying, Ditch Siltation Removal and Disposal, Unclassified Excavation, Fill Compaction, Borrow Fill Work, Placement of Excess Suitable Fill From Excavation for Utilities, Excavation and Placement of Suitable Dry Material Obtained from the Future Wharf 6 Area If Needed, Providing Topsoil Placement and Hydromulch Seeding, Stockpiling of Suitable Excess Material On-Site, and Stockpiling of Unsuitable Material on PHA Property as Directed, and all other cut and fill items as needed to achieve the finished grades shall be paid for on Lump Sum basis. It shall include all costs for loading, hauling, and removing of unsuitable materials from the project site and placing material on other nearby PHA property, complete and accepted, and all incidentals in accordance with these specifications.
B. Contractor is to perform a site survey of the existing condition prior to earth moving activities, as described in 01 50 00.00 Temporary Facilities and Controls. Contractor shall also perform interim surveys of excavated areas for preparation of quantities, if needed for verification of monthly pay applications. There will be no additional payments or separate payment for this interim survey work. Payments shall be based on the average end method, based on the initial survey performed by the Contractor for removal of or for material placed and accepted in conformance of this specification.

1.4 USE AND MAINTENANCE OF ROADS

A. The Contractor shall conduct his grading and hauling operations in an orderly and safe manner, and he shall protect the travelling public, the operations of the Port of Houston Authority and the operations of other contractors. The Contractor's hauling equipment operating on public roads and streets shall comply with the load limit, speed limit, and other applicable regulations of the City, County and State. On the property of the Port of Houston Authority, the Contractor's hauling operations shall not interfere with the normal operations of the Port of Houston Authority's port facilities or with truck and rail traffic to and from such facilities.

B. The Contractor shall maintain dirt surfaced haul roads used by him and leave them in a condition acceptable to the Port Construction Representative upon completion of their use. Flexible base surfaced and paved roads used by the Contractor shall be repaired by the Contractor at his expense wherever damaged by his operations, and he shall restore such roads to the condition existing prior to such damage.

C. In the event fences must be crossed by the Contractor, such fences shall be opened only as directed by the Port Construction Representative and be kept closed between passage of traffic except as permitted by the Port Construction Representative.

D. Upon completion of the work, the fences shall be repaired to their condition existing prior to the beginning of the Contractor's work.

E. The Contractor shall prevent spillage of earth and other materials being hauled. Where material is spilled on public roads or streets, or on the Port of Houston Authority's surfaced and paved roads, the Contractor shall promptly remove such material so as to maintain such roads and streets in a reasonably clean condition.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

1.5 SCARIFYING, CLEARING AND GRUBBING

A. The Contractor shall remove and dispose of all trees, stumps, brush, roots, logs and other vegetation and all debris from within all of the sites that are to be excavated, filled or graded. The Contractor shall remove all grass and roots of shrubs to a depth of at least 6 inches, and grub out tree roots larger than 2 inches in diameter to a depth of at least 18 inches. Topsoil stripping of the surface soil possessing the characteristic which would produce and sustain grass and other vegetative growth shall be removed.
Remove and dispose of all products resulting from stripping of the site. Do not allow material to accumulate at locations in or about the work areas.

B. All trash and debris such as stones, brick, broken concrete, lumber, scrap metal, paper, and other refuse larger than 4 inches in diameter shall be removed.

C. All cleared and grubbed material shall become the property of the Contractor, to be disposed of off the Port of Houston Authority’s property.

1.6 EXCAVATION

A. Excavation is defined as the removal of earth, loose rock, gravel, shell, and, except those materials to be removed under Section 3.1, SCARIFYING, CLEARING AND GRUBBING, above, any other materials encountered in securing the proper subgrade in each area as shown on the Drawings. Excavation shall include the removal of unsuitable materials from the subgrade or existing ground to receive fill as required by these Specifications or as directed by the Port Construction Representative and the excavation of drainage ditches, side slopes of cuts, and shoulder areas adjoining subgrades for pavements and railroads.

B. All excavation will be unclassified as to type.

C. All acceptable excavated materials shall be used in making fills and backfills, as required, within the limits of the project.

D. The Contractor shall remove from pavement and railroad subgrades, from all other areas to be graded, and from areas to receive fill, all muck and spongy or unstable materials which will not consolidate to a depth to be determined by the Port Construction Representative and refill the space with acceptable material. Backfill material shall be placed in accordance with the requirements for compacted embankment.

E. If the Contractor for any reason fails to use diligent care in excavating and preparing rough grade for compaction and there is a deficiency of earth after compacting of finish subgrade surfaces, then he shall fill such low areas and recompact as directed by the Port Construction Representative without extra compensation.

F. Excavations shall be made to the cross sections, lines and elevations shown on the Drawings.

G. In undercut areas, the volume of unstable soil below the top of subgrade shall be measured by "before" and "after" cross sections and the quantity determined by the method of average end areas. The removal of unstable soil and the backfilling with suitable soil of such undercut areas shall be paid for per cubic yard.

1.7 COMPACTION OF NATURAL GROUND AND SUBGRADE

A. Compaction Requirements:

1. All natural ground and excavated areas which are to receive compacted embankment shall be compacted to a depth of eight (8) inches. In select areas the Contractor is allowed to "bridge" a soft spot, with a required compaction of 90% or more standard proctor density for the first lift. Beyond, Contractor is to install material in accordance with the specification. Inspector is to identify the location of
any bridging. Upon completion of the installation of material to top of subgrade, Port Construction Representative’s testing lab shall test density (at Contractor’s expense) of compacted, un-stabilized soil at location above bridging to determine if material is compacted as specified. Bridging of soft spots will not be permitted where top of subgrade will be less than 16 inches above original grade. All railroad subgrades shall be compacted to a depth of not less than eight (8") inches for a width of not less than ten (10’) feet each side of the centerline of each track. All pavement subgrades shall be compacted likewise over the area of such pavement and its sub-base. Shoulders for roadway pavements and other areas, if designated to be compacted on the Drawings or in the Technical Specifications, shall be compacted likewise.

2. The top eight (8") inches of natural ground and cut sections to be compacted within the above limit shall be scarified, wetted or dried to produce optimum moisture content, and compacted to a density of not less than ninety-five (95%) percent of maximum laboratory dry density as determined in accordance with ASTM D698 (Standard Proctor compaction test). Compaction tests will be performed by Port of Houston Authority's Inspector or by a commercial testing laboratory retained and paid for by the Port of Houston Authority.

B. Compaction Equipment:

1. A self-propelled tamping roller or other type of roller meeting the approval of the Port Construction Representative, the weight of which shall be compatible to the type of soil and depth of compaction, shall be used for the compactive effort. The projection of the feet of the tamping roller shall be equal to or greater than the depth of the layer to be compacted.

2. A powered mechanical, hand-held tamper of a type suitable for compacting soil, as approved by the Port Construction Representative, shall be used in restricted space areas where roller and pneumatic tire compacting equipment cannot be operated.

1.8 CONSTRUCTION OF COMPACTED FILLS AND BACKFILLS

A. The hauling, placing and compaction of excavated material for earth embankments, fills or backfills, shall be performed in accordance with the following requirements.

B. Soils acceptable for fill or backfill shall be free of organic matter such as roots and other vegetable matter subject to decay and any other material which would affect the stability of the fill. Foreign debris (wood, concrete, or other extraneous material) larger than 8 inches in diameter or 1 foot square is not allowed and is to be removed from backfill. Except as allowed by the Port Construction Representative in writing, fill or backfill shall have the following characteristics when tested in accordance with standard ASTM procedures:

2. Application of lime slurry to modify the soil properties to meet the plasticity index requirement of item “1.” above.

C. The Port Construction Representative shall be the judge of the suitability or unsuitability of excavated materials for use in fills and backfills. Unsuitable materials shall be disposed of as provided under Section 3.9, DISPOSAL OF EXCESS MATERIALS.

D. In the event that ground water is encountered, semi-compacted backfill shall be placed from the bottom of the excavation to one foot aboveground water elevation, or as directed by the Port Construction Representative. Backfill shall be placed in maximum lifts of one foot each (loose measurement) and compacted by crawler tractor or other
approved means to obtain the maximum practical density. Bottom of excavation will not require compaction in this event.

E. All compacted fill or backfill called for under these specifications or as shown on the Drawings shall be placed from one foot above groundwater level, from the bottom of the excavation or from natural ground as the case may be. Each layer shall extend across an entire fill or backfill section. Each layer shall be wetted or dried to be no wetter than 3 percent (+3%) to no drier than 3 percent (-3%) from optimum moisture content, and compacted to a density of not less than ninety-five (95%) percent of maximum laboratory dry density as determined in accordance with ASTM D698 (Standard Proctor compaction test), except the top layer of the subgrade shall be compacted to one hundred (100%) percent of such maximum.

F. If the material to be compacted contains excessive or insufficient moisture to permit compaction in accordance with the above requirement, the Contractor shall manipulate the material to reduce moisture content or add water to increase moisture content to obtain the specified density. The Inspector may test soil for moisture content before compaction, and in the event the soil has less than optimum moisture, or is likely to lose enough moisture prior to completion of compaction to bring the moisture content below optimum, the Contractor shall add water and thoroughly mix the soil layer before compacting.

G. When necessary to key in the previous layer, the upper surface of each compacted layer of the fill or backfill and the upper surface of ground compacted in place shall be scarified to a depth of one inch (1") just prior to the placing of the succeeding layer of embankment thereon, to provide a blending and interlocking of the adjoining surfaces of the two layers. In areas where the previous compacted layer has compactor roller teeth indentations one-half inch (1/2") to one inch (1") deep and, in the opinion of the Port Construction Representative, has good anchorage for the next layer, no scarification shall be necessary. The soil shall be placed in layers not greater than eight inches (8") in depth (compacted depth) after each preceding layer has been prepared as described hereinabove.

H. Equipment to be used for compaction of fills and backfills shall be the same as specified hereinbefore in Section 3.4 B, COMPACTION EQUIPMENT.

I. After the compaction of each layer of soil is completed, density tests will be made by the Port Construction Representative. If the material fails to meet the density specified, the course shall be reworked as necessary, at the expense of the Contractor, to obtain the specified density. Subject to the approval of the Port Construction Representative, the Contractor may alter his compaction method on subsequent work to obtain the specified density.

J. Compacted strips that are to be left temporarily or overnight may be partially sealed by rolling with pneumatic tire roller to reduce the loss or gain of moisture.

1.9 FINISH GRADING

A. Compacted subgrades and the top surfaces of fills and backfills in areas to receive pavements or railroad tracks or in other areas specified shall be sealed with a pneumatic roller and finished to a smooth surface with a grader blade to the line and grade required.

B. All grading shall conform to the location, size and elevations shown on the Drawings. Railroad and pavement subgrades shall be graded to the planned elevations so that the
thickness of pavement base and pavement and track sub-ballast and ballast will not be less than that shown on the Drawings.

C. No equipment or hauling shall be permitted on finished subgrades except by special permission of the Port Construction Representative and then only where special protection is provided. Any damage caused to such portions of the subgrade by the operations of this Contractor shall be repaired by him at his own cost.

D. Should the subgrade, for any reason or cause, lose the required stability, density or finish before the pavement base or railroad sub-ballast is placed, it shall be recompacted and refinshed at the expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling and/or sealing.

E. For pavement only, the subgrade shall be thoroughly wetted down sufficiently in advance of the placing of any base course to ensure its being in a firm and moist condition for at least two inches (2”) below the surface.

F. Sufficient subgrade shall be prepared in advance to ensure satisfactory prosecution of the work of placing pavement base or railroad sub-ballast.

1.10 BACKFILL BEHIND CURBS

A. The space behind curbs or roadway pavements, except areas to be paved, shall be backfilled with selected material and compacted with truck traffic or by other means acceptable to the Port Construction Representative. The first layer of backfill may be of sufficient depth to permit the use of truck traffic for compacting the material. Succeeding layers shall not exceed eight inches (8”) in depth, loose measurement.

B. Backfill shall be placed above the top of the curbs and finished to the roadway cross sections shown on the Drawings or, if not shown, to a rounded surface to provide drainage of the area behind the curbs.

1.11 DITCHES AND SLOPES

A. Drainage ditches, including the bottom and side slopes thereof, and the side slopes of cut sections and subgrade for railroads in cut sections beyond ten feet (10’) from the centerline of any track shall be excavated without undercutting and fine graded to the cross sections, lines and elevation shown on the Drawings. Any of these areas undercut below finish grade shall be backfilled with material approved by the Port Construction Representative and compacted to a dry density equal to or greater than that of the surrounding undisturbed natural ground. No other compaction will be required for these areas except as may be provided by these Technical Specifications.

B. The side slopes of embankment fills shall be compacted in each layer of compacted fill from base to top of embankment. The width of embankment layers shall be constructed slightly in excess of the planned width to permit the blading of side slopes to remove the loose edge material, to eliminate irregularities in the sloping surfaces, to complete the embankment to the cross section shown on the Drawings and to ensure compaction of the entire fill.

1.12 DISPOSAL OF EXCESS MATERIALS

A. Unless otherwise provided in these Technical Specifications, all unsuitable excavated materials and all excess unsuitable earthen materials, trash, and debris shall become
the property of the Contractor and shall be removed from Port of Houston Authority's premises at the Contractor's expense.

1.13 PROTECTION OF EXISTING STRUCTURES

A. The Contractor will be held responsible for any damage to manholes, inlets, valves, pipes, or other facilities, caused by him in making the necessary excavation and fills. The Contractor shall repair all such damage at his expense.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 23 23.13 Add - UTILITY BACKFILL MATERIALS

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes:

1. Material Classifications.
2. Utility Backfill Materials:
   a. Concrete sand.
   b. Gem sand.
   c. Pea gravel.
   d. Crushed stone.
   e. Crushed concrete.
   f. Bank run sand.
   g. Select backfill.
   h. Random backfill.
3. Material Handling and Quality Control Requirements.

1.2 RELATED SECTIONS

A. 31 23 35.00 - Excavation and Backfill for Utilities
B. 31 23 34.00 - Structural Excavation, Fill and Backfill
C. 31 32 13.17 - Cement Stabilized Sand Fill
D. 32 13 15.00 - Concrete for Utility Construction
E. 32 95 10.00 - Pavement Repair and Resurfacing

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

A. ASTM C 33 - Specification for Concrete Aggregate.
B. ASTM C 40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
H. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).

L. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

M. TxDOT Tex-104-E - Test Method for Determination of Liquid Limit of Soils (Part 1)

N. TxDOT Tex-106-E - Test Method - Methods of Calculating Plasticity Index of Soils.

O. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment will be made for backfill materials under this Section. Include cost in the unit price for installed underground piping, sewer, conduit, or duct work.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit a description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials to comply with Paragraph 2.3, Materials Testing.

D. For each delivery of material, provide a delivery ticket which includes source location.

1.6 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:
   1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
   2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.
   3. Materials that contain large clods, aggregates, and stones greater than 4 inches in any dimension; debris, vegetation, and waste; or any other deleterious materials.
   4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials are the following:
   1. Those meeting specification requirements.
   2. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement.

C. Foundation Backfill Materials:
   Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base:
   Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.
E. Backfill Material:
Classified soil material meeting specified quality requirements for the designated application as embedment or trench zone backfill.

F. Embedment Material:
Soil material placed under controlled conditions within the embedment zone extending vertically upward from the top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching, and initial backfill.

G. Trench Zone Backfill:
Classified soil material meeting specified quality requirements and placed under controlled conditions in the trench zone from top of embedment zone to base course in paved areas or to the surface grading material in unpaved areas.

H. Foundation:
Either suitable soil of the trench bottom, or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source:
A source selected by the Contractor for supply of embedment or trench zone backfill material. A selected source may be the project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Section 31 23 35.00 - Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

K. Perform tests of sources for backfill material in accordance with Paragraph 2.3B.

L. Verification tests of backfill materials may be performed by the Port of Houston Authority. Refer to Material Testing in the General Conditions.

M. Random fill obtained from the project excavation as source is exempt from prequalification requirements by Contractor but must be inspected by an independent testing laboratory, employed and paid by the Port of Houston Authority, for unacceptable materials based on ASTM D 2488.

1.7 TESTS
A. Perform tests of sources for backfill material in accordance with Paragraph 2.3B.
B. Verification tests of backfill materials may be performed by the Port of Houston Authority in accordance with Paragraph 3.3.
C. Random fill obtained from the project excavation as source is exempt from prequalification requirements by Contractor but must be inspected by Port of Houston Authority testing lab for unacceptable materials based on ASTM D 2488.

PART 2 PRODUCTS
2.1 Material Classifications
A. Materials for backfill shall be classified for the purpose of quality control in accordance with the Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.1B, or by product descriptions, as given in Paragraph 2.2.
B. Class Designations Based on Laboratory Testing:
1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
   a. Plasticity index: nonplastic.
   b. Gradation: \( \frac{D_{60}}{D_{10}} \) - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent. Maximum size not to exceed that recommended by pipe manufacturer or 1/2", whichever is less.

2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines:
   a. Plasticity index: nonplastic to 4.
   b. Gradations:
      1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
      2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
      3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.

3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
   a. Plasticity index: greater than 7.
   b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.

   a. Plasticity Indexes:
      1) Plasticity index: greater than 7, and above A line.
      2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
   b. Liquid limit: less than 50.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.

5. Class IVB: Fat clays (CH)
   a. Plasticity index: above A line.
   b. Liquid limit: 50 or greater.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.

6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to the more restrictive class.

2.2 Product Descriptions
   A. Soils classified as silt (ML), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by the Chief Engineer. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by the applicable backfill installation specification. Refer to Section 31 23 34.00 - Structural Excavation, Fill and Backfill and Section 31 23 35.00 - Excavation and Backfill for Utilities.
B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to the following limits for deleterious materials:

1. Clay Lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.
2. Lightweight Pieces: Less than 5 percent when tested in accordance with ASTM C 123.
3. Organic Impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in the product specification, and approved by the Chief Engineer, provided that the physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by the Unified Soil Classification System (ASTM D 2487) meeting the following requirements:

1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM D 1140. The amount of clay lumps or balls not exceeding 2 percent.
2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318:
   a. Liquid limit: not exceeding 25 percent.
   b. Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or a combination of natural and manufactured sand conforming to the requirements of ASTM C 33 and graded within the following limits when tested in accordance with ASTM C 136:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>95 to 100</td>
</tr>
<tr>
<td>No. 8</td>
<td>80 to 100</td>
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<tr>
<td>No. 16</td>
<td>50 to 85</td>
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<tr>
<td>No. 30</td>
<td>25 to 60</td>
</tr>
<tr>
<td>No. 50</td>
<td>10 to 30</td>
</tr>
<tr>
<td>No. 100</td>
<td>2 to 10</td>
</tr>
</tbody>
</table>

F. Gem Sand: Sand conforming to the requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>95 to 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>60 to 80</td>
</tr>
<tr>
<td>No. 8</td>
<td>15 to 40</td>
</tr>
</tbody>
</table>
G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>85 to 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>10 to 30</td>
</tr>
<tr>
<td>No. 8</td>
<td>0 to 10</td>
</tr>
<tr>
<td>No. 16</td>
<td>0 to 5</td>
</tr>
</tbody>
</table>

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for the same construction activity from a single source.
2. Non-plastic fines.
3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.
4. Crushed aggregate shall have a minimum of 90 percent of the particles retained on the No. 4 sieve with 2 or more crushed faces as determined by Test Method Tex-460-A, Part I.
5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from a naturally occurring single source. Uncrushed gravel are not acceptable materials for embedment where crushed stone is shown on the applicable utility embedment drawing details.
6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are the same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.
7. Gradations, as determined in accordance with Tex-110-E.

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;15&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>95 - 100</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>60 - 90</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>25 - 60</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>-</td>
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<tr>
<td>No. 4</td>
<td>0 - 5</td>
</tr>
<tr>
<td>No. 8</td>
<td>-</td>
</tr>
</tbody>
</table>

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with a plasticity index between 7 and 20 or clayey soils treated with lime to meet plasticity criteria.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by the applicable backfill installation specification. Refer to Section 31 23 34.00 - Structural Excavation, Fill and Backfill and Section 31 23 35.00 - Excavation and Backfill for Utilities.

K. Cement Stabilized Sand: Conform to requirements of Section 31 32 13.16 - Cement Stabilized Sand Fill.
L. Concrete Backfill: Conform to Class B concrete as specified in Section 32 13 15.00 - Concrete for Utility Construction.

2.3 Material Testing

A. Ensure that material selected, produced and delivered to the project meets applicable specifications and is of sufficient uniform properties to allow practical construction and quality control.

B. Source or Supplier Qualification. Perform testing, or obtain representative tests by suppliers, for selection of material sources and products. Provide test results for a minimum of three samples for each source and material type. Tests samples of processed materials from current production representing material to be delivered. Tests shall verify that the materials meet specification requirements. Repeat qualification test procedures each time the source characteristic changes or there is a planned change in source location or supplier. Qualification tests shall include, as applicable:

1. Gradation. Complete sieve analyses shall be reported regardless of the specified control sieves. The range of sieves shall be from the largest particle through the No. 200 sieve.
2. Plasticity of material passing the No. 40 sieve.
3. Los Angeles abrasion-wear of material retained on the No. 4 sieve.
5. Lightweight pieces
6. Organic impurities

C. Production Testing. Provide reports to the Port Construction Representative from an independent testing laboratory that backfill materials to be placed in the Work meet applicable specification requirements.

D. Assist the Port Construction Representative in obtaining material samples for verification testing at the source or at the production plant.

PART 3 EXECUTION

3.1 Sources

A. Use of material encountered in the trench excavations is acceptable, provided applicable specification requirements are satisfied. If excavation material is not acceptable, provide from other approved source.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that the Port Construction Representative may obtain samples for verification testing.

C. Obtain approval for each material source by the Port Construction Representative before delivery is started. If sources previously approved do not produce uniform and satisfactory products, furnish materials from other approved sources. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet the requirements of the specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or contamination. Once a material is approved by the Port Construction Representative, expense for sampling and testing required to change to a different material will be credited to the through a change order.

D. Bank run sand, select backfill, and random backfill, if available in the project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete the work from off-site sources.

E. The Port of Houston Authority does not represent or guarantee that any soil found in the excavation work will be suitable and acceptable as backfill material.
3.2 Material Handling

A. When backfill material is obtained from either a commercial or non-commercial borrow pit, open the pit to expose the vertical faces of the various strata for identification and selection of approved material to be used. Excavate the selected material by vertical cuts extending through the exposed strata to achieve uniformity in the product.

B. Establish temporary stockpile locations for practical material handling and control, and verification testing by the Port Construction Representative in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near the project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering the drainage system. Refer to Project Storm Water Pollution Prevention Plan.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.3 Field Quality Control

A. Quality Control:
   1. The Port Construction Representative may sample and test backfill at:
      a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
      b. On-site stockpiles.
      c. Materials placed in the Work.

   2. The Port Construction Representative may resample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: The Port of Houston Authority’s testing laboratory will provide verification testing on backfill materials, as directed by the Port Construction Representative. Samples may be taken at the source or at the production plant, as applicable.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 23 34.00 Add - STRUCTURAL EXCAVATION, FILL AND BACKFILL

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes all excavation for the placing of structures and foundations of structures except drilled footings or building foundations; for the disposal of all excess material obtained from such excavation; and for the backfilling around complete structures to the level of the original ground or to finish grade as shown on the Drawings. The work to be done shall include all necessary pumping or bailing, drainage, sheeting, bracing of sheeting and the removal of any sheeting required. Unless otherwise provided, the work included hereunder shall provide for the removal of old structures or portions thereof, trees, and all other obstructions necessary to complete the proposed construction.

1.2  RELATED SECTIONS

A. 02 30 00.00 Building Pad, Dug Foundations, and Footings

1.3  REFERENCES

A. ASTM D 698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

1.4  MEASUREMENT AND PAYMENT

A. Unit Price

1. Subject to Section III, there is no separate payment for structural excavation, fill, and backfill under this Section. Include payment in unit price items for which structural excavation, fill, and backfill is a component.

2. EXCEPT payment for “Fill” under the future Stevedore Buildings and Crane Loop Switch Area, when used as part of the pavement section as shown on the Drawings, will be paid for on a square yard basis for material placed and compacted to the depth indicated on the plans.

1.5  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.
PART 2 PRODUCTS  (Not Used)

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION FOR FLOOR SLAB

A. The structure area should be stripped of all vegetation, topsoil and all deleterious materials. Stripped areas should be appropriately graded and shaped to provide positive drainage.

B. Exposed subgrade should be proof-rolled with heavy construction equipment to identify any weak areas. Any weak areas, if encountered, should be excavated to firm subgrade and be replaced with select fill.

C. Exposed subgrade should be compacted to at least 95 percent of the materials maximum dry density determined according to ASTM D698 at a moisture content equal to (+/-3) percentage points of the optimum value.

3.2 PUMPING OR BAILING

A. Pumping or bailing from the interior of any foundation enclosure shall be done in such manner as to preclude possibility of the movement of water through or alongside any concrete being placed. No pumping or bailing will be permitted during the placing of concrete or for a period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall. Pumping or bailing to dewater an excavation having a seal slab shall not be started until the seal slab has set at least 36 hours.

3.3 FILL AND BACKFILL

A. As soon as practicable, all spaces excavated under this Specification and not occupied by the permanent structure shall be backfilled.

B. Fill and backfill should be compacted to at least 95 percent of the materials maximum dry density determined according to ASTM D698 at a moisture content equal to (+/-3) percentage points of the optimum value.

C. Select fill required to raise the grade should consist of sandy lean clay or lean clay with a liquid limit less than 40 and a plasticity index between 7 and 20.

D. Fill material should be placed in loose lifts not exceeding eight inches and should be compacted to 95 percent of the maximum dry density as determined by ASTM D698.

E. A minimum 4-inch thick layer of clean, well graded sand shall be placed beneath slabs.

F. No backfill shall be placed against any retaining wall until such structure has been in place at least 10 days. Concrete must retain at least 85% of its design strength before backfill is placed.

G. Backfill placed around footings and piers shall be deposited on both sides to approximately the same elevation at the same time.
H. Care shall be taken to prevent any wedging action of backfill against the structure when such action would increase stresses in the structure, and the slopes bounding the excavation in such cases shall be stepped or serrated to prevent such wedge action.

I. No backfilling shall be done except in the presence of the Port Construction Representative or his authorized representative.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 23 35.00 Add - EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.2 RELATED SECTIONS

A. 01 50 00.00 - Temporary Facilities and Controls
B. 01 55 26.13 - Traffic Control and Regulation
C. 01 57 25.00 - Ground Water and Surface Water Control
D. 31 05 19.13 - Geotextile
E. 31 23 23.13 - Utility Backfill Materials
F. 31 41 33.00 - Trench Safety System
G. 32 13 15.00 - Concrete for Utility Construction.

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

B. ASTM D 558 - Test Methods for Moisture-Density Relations of Soil Cement Mixtures.
C. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (304.8-mm) Drop.
D. ASTM D 1556 - Test Method for Density in Place by the Sand-Cone Method.
F. ASTM D 2487 - Classification of Soils for Engineering Purposes.
G. ASTM D 2922 - Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
H. ASTM D 3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
K. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.
1.4 MEASUREMENT AND PAYMENT

A. No separate payment will be made for trench excavation, embedment and backfill for utilities under this Section. Include cost in unit price for installed underground piping, sewer, conduit or duct work.

B. When the Port Construction Representative directs the Contractor to over excavate the trench bottom, the Contractor will be paid by unit price per linear foot.
   1. No payment will be made if the Port Construction Representative does not direct the Contractor to over excavate the trench bottom.
   2. No over excavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01 57 25.00 - Ground Water and Surface Water Control.

C. No separate or additional payment will be made for surface water control, ground water control, or for excavation drainage. Include payment in the unit price for the installed piping, sewer, conduit, or duct work.

D. No separate payment will be made for performing Critical Location exploratory excavation. Include cost in unit price for work requiring critical location.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit a written description for information only of the planned typical method of excavation, backfill placement and compaction, including:
   1. Sequence of work and coordination of activities.
   2. Selected trench widths.
   3. Procedures for foundation and embedment placement, and compaction.
   4. Procedure for use of trench boxes and other pre-manufactured systems while assuring specified compaction against undisturbed soil.
   5. Procedure for installation of Special Shoring at locations identified on the Drawings.

C. Submit a ground and surface water control plan in accordance with requirements in this Section and Section 01 57 25.00 - Ground Water and Surface Water Control.

D. Submit backfill material sources and product quality information in accordance with requirements of Section 31 23 23.13 - Utility Backfill Materials.

E. Submit a trench excavation safety program in accordance with requirements of Section 31 41 33.00 - Trench Safety System. Include designs for special shoring meeting the requirements defined in Paragraph 1.8, Special Shoring Design Requirements.

F. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

1.6 DEFINITIONS

A. Pipe Foundation:
   Suitable and stable native soils that are exposed at the trench subgrade after excavation to depth of bottom of the bedding as shown on the Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding:
   The portion of trench backfill that extends vertically from top of foundation up to a level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.
C. Haunching:
The material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill:
The portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to a level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment:
The portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone:
The portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material:
Unsuitable soil materials are the following:
1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
2. Materials that cannot be compacted to required density due to either gradation, plasticity, or moisture content.
3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material:
Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement are considered suitable, unless otherwise indicated.

I. Backfill:
Suitable material meeting specified quality requirements, placed and compacted under controlled conditions.

J. Ground Water Control Systems:
Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01 57 25.00 - Ground Water and Surface Water Control.

K. Surface Water Control:
Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as a part of excavation drainage.

L. Excavation Drainage:
Removal of surface and seepage water in trench by sump pumping and using a drainage layer, as defined in ASTM D 2321, placed on the foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to the stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective
placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as a result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.
   a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
   b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in the embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in the pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Subtrench:
Subtrench is a special case of benched excavation. Subtrench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of a subtrench depends upon trench stability and safety as determined by the Contractor.

O. Trench Dam:
A placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along the trench.

P. Over-Excavation and Backfill:
Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.

Q. Foundation Backfill Materials:
Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 31 41 33.00 - Trench Safety System.

S. Trench Shield (Trench Box):
A portable worker safety structure moved along the trench as work proceeds, used as a protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within the trench. Trench shields may be stacked if so designed or placed in a series depending on depth and length of excavation to be protected.

T. Shoring System:
A structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of the ground affecting adjacent installations or improvements.
U. Special Shoring:
A shoring system meeting special shoring as specified in Paragraph 1.8, Special Shoring Design Requirements, for locations identified on the Drawings.

1.7 SCHEDULING
A. Schedule work so that pipe embedment can be completed on the same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.8 TESTS
A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory employed and paid by the Port of Houston Authority in accordance with requirements of Material Testing in the General Conditions and as specified in this Section.
B. Perform backfill material source qualification testing in accordance with requirements of Section 31 23 23.13 - Utility Backfill Materials.

1.9 SPECIAL SHORING DESIGN REQUIREMENTS
Have special shoring designed or selected by the Contractor's Professional Engineer to provide support for the sides of the excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by the Contractor's Professional Engineer to meet the project site requirements based on the manufacturer’s standard design.

PART 2 PRODUCTS

2.1 Equipment
A. Perform excavation with hydraulic excavator or other equipment suitable for achieving the requirements of this Section.
B. Use only hand-operated tamping equipment until a minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.
C. Use trench shields or other protective systems or shoring systems, which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.
D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.8, Shoring Design Requirements.

2.2 Material Classifications
B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 32 13 15.00 - Concrete for Utility Construction.
C. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.
D. Timber Shoring Left in Place: Untreated oak.
PART 3  EXECUTION

3.1 Standard Practice

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.

B. Install rigid pipe to conform with standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.

3.2 Preparation

A. Establish traffic control to conform with requirements of Section 01 55 26.13 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by the Work, and is considered hazardous to traffic movements.

B. Perform work to conform with applicable safety standards and regulations. Employ a trench safety system as specified in Section 31 41 33.00 - Trench Safety System.

C. Immediately notify the agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from the Port Construction Representative and agency for any repairs or relocations, either temporary or permanent.

D. Install and operate necessary dewatering and surface water control measures to conform with Section 01 57 25.00 – Ground Water and Surface Water Control.

E. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with the requirements of the General and Special Conditions.

3.3 Protection

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within the grading limits as designated on the Drawings, and in accordance with requirements of Section 01 50 00.00 – Temporary Facilities and Controls.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to Port of Houston Authority.

3.4 Excavation

A. Except as otherwise specified or shown on the Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on the Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.
C. Determine trench excavation widths using the following schedule as related to pipe outside diameter (O.D.). Maximum trench width shall be the minimum trench width plus 24 inches.

<table>
<thead>
<tr>
<th>Nominal Pipe Size, Inches</th>
<th>Minimum Trench Width, Inches</th>
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</thead>
<tbody>
<tr>
<td>Less than 18</td>
<td>O.D. + 18</td>
</tr>
<tr>
<td>18 to 30</td>
<td>O.D. + 24</td>
</tr>
<tr>
<td>Greater than 30</td>
<td>O.D. + 36</td>
</tr>
</tbody>
</table>

D. Use sufficient trench width or benches above the embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from the surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify the Port Construction Representative and obtain instructions before proceeding.

F. Shoring of Trench Walls.
   1. Install Special Shoring in advance of trench excavation or simultaneously with the trench excavation, so that the soils within the full height of the trench excavation walls will remain laterally supported at all times.
   2. For all types of shoring, support trench walls in the pipe embedment zone throughout the installation. Provide trench wall supports sufficiently tight to prevent washing the trench wall soil out from behind the trench wall support.
   3. Unless otherwise directed by the Port Construction Representative, leave sheeting driven into or below the pipe embedment zone in place to preclude loss of support of foundation and embedment materials. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and the trench wall in the vicinity of the pipe zone.
   4. Employ special methods for maintaining the integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.
   5. If sheeting or other shoring is used below top of the pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into the embedment zone shall be the equivalent of a 1-inch-thick steel plate. Fill voids left on removal of supports with compacted backfill material.

G. Use of Trench Shields. When a trench shield (trench box) is used as a worker safety device, the following requirements apply:
   1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to the trench sidewalls.
   2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor the degree of compaction reduced.
   3. When required, place, spread, and compact pipe foundation and bedding materials beneath the shield. For backfill above bedding, lift the shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
   4. Maintain trench shield in position to allow sampling and testing to be performed in a safe manner.
3.5 Handling Excavated Materials
A. Use only excavated materials which are suitable as defined in this Section and conforming to Section 31 23 23.13 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at a distance from the trench to prevent slides or cave-ins.
B. When required, provide additional backfill material conforming to requirements of Section 31 23 23.13 - Utility Backfill Materials.
C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect excess stockpiles for use on site. Maintain site conditions in accordance with Section 01 50 00.00 - Temporary Facilities and Controls.

3.6 Ground Water Control
A. Implement ground water control according to Section 01 57 25.00 - Ground Water and Surface Water Control. Provide a stable trench to allow installation in accordance with the Specifications. No Separate Pay for groundwater control.

3.7 Trench Foundation
A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.
B. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.8 Pipe Embedment, Placement, And Compaction
A. Immediately prior to placement of embedment materials, the bottoms and sidewalls of trenches shall be free of loose, sloughing, caving, or otherwise unsuitable soil.
B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.
C. For pipe installation, manually spread embedment materials around the pipe to provide uniform bearing and side support when compacted. Do not allow materials to free-fall from heights greater than 24 inches above top of pipe. Perform placement and compaction directly against the undisturbed soils in the trench sidewalls, or against sheeting which is to remain in place.
D. Do not place trench shields or shoring within height of the embedment zone unless means to maintain the density of compacted embedment material are used. If moveable supports are used in embedment zone, lift the supports incrementally to allow placement and compaction of the material against undisturbed soil.
E. Place geotextile to prevent particle migration from the in-situ soil into open-graded (Class I) embedment materials or drainage layers.
F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.
G. Place haunching material manually around the pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside the pipe with sand bags or other suitable means.
H. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

I. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 31 23 23.13 - Utility Backfill Material. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:

1. Class I, II, and III Embedment Materials:
   a. Maximum 6-inch compacted lift thickness.
   b. Compact to achieve a minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
   c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Port Construction Representative.

2. Cement-Stabilized Sand:
   a. Maximum 6-inch compacted thickness.
   b. Compact to achieve a minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
   c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.

3. Class I Embedment Materials:
   a. Maximum 6-inch compacted lift thickness.
   b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed the pipe to meet the deflection test criteria.
   c. Moisture content as determined by Contractor for effective compaction without softening the soil of trench bottom, foundation or trench walls.

4. Class II Embedment and Cement-Stabilized Sand:
   a. Maximum 6-inch compacted thickness.
   b. Compaction by methods determined by Contractor to achieve a minimum of 95 percent of the maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.
   c. Moisture content of Class II materials within 2 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on the dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.

J. Place trench dams in Class I embedments in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.
3.9 Trench Zone Backfill Placement And Compaction

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only the minimum length of trench open as necessary for construction.

B. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave the sheeting in place. Cut off sheeting 1.5 feet or more above the crown of the pipe. Remove trench supports within 5 feet from the ground surface.

C. For sewer pipes, use backfill materials described here as determined by trench limits. As trench zone backfill in paved areas for streets and to one foot back of curbs and pavements, use cement stabilized sand for pipe of nominal sizes less than 36 inches. Uniformly backfill trenches partially within limits one foot from streets and curbs according to the paved area criteria. Backfill with select fill within one foot below pavement subgrade for rigid pavement. For asphalt concrete, use flexible base material within one foot below pavement subgrade.

D. For water lines, backfill in trench zone, including auger pits, with bank run sand or select fill as specified in Section 31 23 23.13 - Utility Backfill Material.

E. When shown on Drawings, a random backfill of suitable material may be used in trench zone for trench excavations outside pavements.

F. Place trench zone backfill in lifts and compact by methods selected by the Contractor. Fully compact each lift before placement of the next lift.

1. Bank Run Sand:
   a. Maximum 9-inch compacted lift thickness.
   b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.
   c. Moisture content within 3 percent of optimum determined according to ASTM D 698

2. Cement-Stabilized Sand:
   a. Maximum 8-inch loose lift thickness.
   b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 558.
   c. Moisture content on the dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Select Fill:
   a. Maximum 6-inch compacted thickness.
   b. Compaction by equipment providing tamping or kneading impact to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.
   c. Moisture content within 2 percent of optimum determined according to ASTM D 698.

G. For trench excavations outside proposed or future pavements, a random backfill of suitable material may be used in the trench zone.
1. Fat clays (CH) may be used as trench zone backfill outside paved areas at the Contractor’s option. If the required density is not achieved, the Contractor, at his option and at no additional cost to the Port of Houston Authority may use lime stabilization to achieve compaction requirements or use a different suitable material.
3. Compact to a minimum of 90 percent of the maximum dry density determined according to ASTM D 698.
4. Moisture content as necessary to achieve density.

H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 Manholes, Junction Boxes, And Other Pipeline Structures
A. Meet the requirements of adjoining utility installations for backfill of pipeline structures, as shown on the Drawings.

3.11 Field Quality Control
A. Test for material source qualifications as defined in Section 31 23 23.13 - Utility Backfill Materials.
B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Port of Houston Authority.
C. Tests will be performed on a minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.
D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement-stabilized sand in accordance with ASTM D 558. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.
E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions.
1. A minimum of one test for every 20 cubic yards of compacted embedment and for every 50 cubic yards of compacted trench zone backfill material.
2. A minimum of three density tests for each full shift of Work.
3. Density tests will be distributed among the placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.
4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.
5. Density tests may be performed at various depths below the fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
6. Two verification tests will be performed adjacent to in-place tests showing density less than the acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
7. Recompacted placement will be retested at the same frequency as the first test series, including verification tests.
F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.
G. Acceptability of crushed rock compaction will be determined by inspection.
3.12 Disposal Of Excess Material

Dispose of excess materials in accordance with requirements of Section 4 of the General Conditions.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes material for use in backfilling against structures or in excavations as called for on the Drawings, or as may be directed by the Port Construction Representative.

1.2 RELATED SECTIONS

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

A. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete


C. ASTM D558 - Standard Test Methods for the Moisture Density Relations of Soil-Cement Mixtures

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this Section. Include price of Cement Stabilized Sand Fill in the unit price of items for which cement stabilized sand fill is a component.

1.5 SUBMITTALS

Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

PART 2 PRODUCTS

2.1 Materials

A. Sand: Sand shall consist of clean sand containing not more than the following percentages of deleterious materials:

1. Material Removed by Decantation: 5.0 percent.

2. Clay Lumps: 0.5 percent.
3. Other Deleterious Substances Such as Coal, Shale, and Coated Grains of Soft, Flaky Particles: 2.0 percent.

4. At the time of its use the sand shall be free of foreign materials such as wood, hay, burlap, dirt, etc., with which it may have become mixed at the stockpiles.

5. When subjected to the color test in accordance with ASTM Specification C40, the sand shall not show a color darker than the Standard Color.

6. The sand shall conform to the following grading requirements:
   a. Retained on 3/8-Inch Screen: 0 percent.
   b. Retained on 1/4-Inch Screen: 0 to 5 percent.
   c. Retained on 20-Mesh Screen: 0 to 50 percent.
   d. Retained on 100-Mesh Screen: 80 to 100 percent.

B. Cement: Cement shall consist of Type I Portland cement conforming to ASTM Specifications C150.

C. Water: Mixing water shall be fresh, clean, and potable.

2.2 Proportioning

A. The mixture shall consist of sand, not less 7 percent by weight of cement for the total weight of the mix, and sufficient water to hydrate the cement.

PART 3 EXECUTION

3.1 Construction Methods

The material shall be placed in layers 8 inches thick and compacted to 97 percent of the maximum laboratory dry density determined by Method A as described in “Standard Test Methods for the Moisture Density Relations of Soil-Cement Mixtures,” ASTM Designation D558. Where cement stabilized sand fill is not confined by sides of excavations or structures the fill shall be extended beyond the required lines and grades sufficiently to ensure complete compaction of material within the required cross section, after which the surplus material may be reused only with prior approval of the Port Construction Representative and only if clean and free of dirt, trash, etc., and if reused promptly before hydration of the cement progresses to the point of initial set.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 32 14.00 Add – LIME-CEMENT STABILIZATION OF SUBGRADE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes the requirements for mix and compact water, lime and cement, and subgrade soil.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.3 MEASUREMENT AND PAYMENT

A. Measurement.

1. Lime and cement treatment will be measured by the Square Yard of surface area of existing subgrade at the depth indicated on the Plans. The dimensions for determining the surface area is established by the widths and the lengths measured at placement, and as indicated on the Plans, complete in place and accepted. Additional area(s) stabilized for the Contractor’s convenience will not be included in measurement for payment.

2. Lime. When lime is furnished in trucks, the weight of lime will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Contractor shall provide corresponding weight tickets.

When lime is furnished in bags, each bag must indicate the manufacturer’s certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer’s certified weight.

a. Hydrated Lime.

Slurry. Lime will be measured by the ton (dry weight) of the hydrated lime used to prepare the lime slurry at the jobsite.

b. Commercial Lime Slurry. Lime slurry will be measured by the ton (dry weight) as calculated from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

c. Quicklime.

i. Dry. Lime will be measured by the ton (dry weight).
ii. Slurry. Lime slurry will be measured by the ton (dry weight) of the quicklime used to prepare the slurry, multiplied by a conversion factor of 1.28 to give the quantity of equivalent hydrated lime, which will be the basis of payment.

3. Cement. Cement will be measured by the ton (dry weight). When cement is furnished in trucks, the weight of cement will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Contractor shall provide corresponding weight tickets.

When cement is furnished in bags, indicate the manufacturer’s certified weight. Bags varying more than 5% from that weight may be rejected. The average weight of bags in any shipment, as determined by weighing 10 bags taken at random, must be at least the manufacturer’s certified weight.

Cement slurry will be measured by the ton (dry weight) of the cement used to prepare the slurry at the job site or from the minimum percent dry solids content of the slurry, multiplied by the weight of the slurry in tons delivered.

1.4 Payment. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid in accordance with Section 4.1.B, “Lime”; Section 4.1.C, “Cement”; and Section 4.1.A, “Lime-Cement Stabilization of Subgrade.”

Asphalt used solely for curing will not be paid for directly, but will be subsidiary to this Item.

Lime and cement used for reworking a section in accordance with Section 3.1.E, “Reworking a Section,” will not be paid for directly but will be subsidiary to this Item.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans.

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade or existing base will be at the Contractor’s expense.

A. Lime and Cement Treatment. Lime and Cement treatment will be paid for at the unit price per Square Yard for ‘Lime-Cement Stabilization of Subgrade’ at the depth specified. No payment will be made for thickness or width exceeding that shown on the plans. This price is full compensation for shaping existing material, loosening, mixing, pulverizing, spreading, providing and applying lime and cement, compacting, finishing, curing including curing materials, water, drying, blading, shaping and maintaining, replacing, disposing of loosened materials, processing, hauling, reworking if required, preparing secondary subgrade, equipment, labor, tools, and incidentals.

B. Lime. No separate payment will be made for providing Lime of the specified type [Hydrated (Dry), Hydrated (Slurry), Commercial Lime Slurry, Quicklime (Dry), Quicklime (Slurry)]. No separate payment will be made for scales, weighing, equipment or incidentals for providing the Lime.

C. Cement. No separate payment will be made for providing Cement. No separate payment will be made for scales, weighing, equipment or incidentals for providing the Cement.
PART 2 PRODUCTS

2.1 MATERIALS. Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of proposed material sources and of changes in material sources. The Engineer will verify that the specification requirements are met before the sources can be used. The Engineer may sample and test project materials at any time before compaction. Use Tex-100-E for material definitions.

A. Lime. Furnish lime that meets the requirements of TxDOT DMS-6350, “Lime and Lime Slurry,” and TxDOT DMS-6330, “Lime Sources Prequalification of Hydrated Lime and Quicklime.” Use hydrated lime, commercial lime slurry, or quicklime as shown on the plans. When furnishing quicklime, provide it in bulk.

B. Cement. Furnish hydraulic cement that meets the requirements of TxDOT DMS-4600, “Hydraulic Cement,” and the TxDOT’s Hydraulic Cement Quality Monitoring Program (HCQMP). Sources not on the HCQMP will require testing and approval before use.

C. Water. Furnish water free of industrial wastes and other objectionable matter.

D. Asphalt. When permitted for curing purposes, furnish asphalt or emulsion in accordance with TxDOT Item 300, “Asphalts, Oils, and Emulsions,” as shown on the plans or as directed.

E. Mix Design. The Engineer will determine the target lime and cement content and optimum moisture content in accordance with Tex-127-E. It is anticipated that the lime content will be 4 percent and the cement content will be 4 percent for the stabilized layer. However, final determination will not be made until soils that will comprise the stabilized layer are placed or identified by Contractor for intended layer. The Contractor may propose a mix design developed in accordance with Tex-127-E. The Port Authority will use Tex-127-E to verify the Contractor’s proposed mix design before acceptance.

2.2 EQUIPMENT. Provide machinery, tools, and equipment necessary for proper execution of the work. Provide rollers in accordance with TxDOT Item 210, “Rolling.” Provide proof rollers in accordance with TxDOT Item 216, “Proof Rolling,” when directed.

A. Storage Facility. Store quicklime, dry hydrated lime, and cement in closed, weatherproof containers.

B. Slurry Equipment. Use slurry tanks equipped with agitation devices to slurry hydrated lime or quicklime on the project or other approved location. The Engineer may approve other slurrying methods. Provide a pump for agitating the slurry when the distributor truck is not equipped with an agitator. Equip the distributor truck with a sampling device in accordance with Tex-600-J, Part I, when using commercial lime slurry.

C. Pulverization Equipment. Provide pulverization equipment that:

- cuts and pulverizes material uniformly to the proper depth with cutters that will plane to a uniform surface over the entire width of the cut,
- provides a visible indication of the depth of cut at all times, and
- uniformly mixes the materials.
PART 3  CONSTRUCTION

3.1 Construct each layer uniformly, free of loose or segregated areas and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

A. Preparation of Subgrade for Treatment. Shape existing material in accordance with applicable proposal items to conform to typical sections shown on the plans and as directed.

B. Pulverization. Pulverize or scarify existing material after shaping so that 100% passes a 2-1/2-in. sieve. If the material cannot be uniformly processed to the required depth in a single pass, excavate and windrow the material to expose a secondary grade to achieve processing to plan depth.

C. Application and Mixing of Lime and Cement. When treating with Lime and Cement, apply, mix, and cure lime first unless otherwise directed. Start treatment operations only when the air temperature is at least 35°F and rising or is at least 40°F. The temperature will be taken in the shade and away from artificial heat. Suspend operations when the Engineer determines that weather conditions are unsuitable. Minimize dust and scattering by wind. Do not apply lime or cement when wind conditions, in the opinion of the Port Authority, cause blowing lime or cement to become objectionable to adjacent land use.

During the interval between application and mixing, sections treated with hydrated lime or cement that have been exposed to the open air for a period of 6 hr. or more, or that experience excessive loss due to washing or blowing, will not be accepted for payment. After mixing and required curing, the Port Authority will sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III, to determine compliance with the gradation requirements in Table 1.

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Subgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/4 in.</td>
<td>100</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>85</td>
</tr>
<tr>
<td>No. 4</td>
<td>60</td>
</tr>
</tbody>
</table>

1. Application of Lime. Uniformly apply lime using dry or slurry placement as shown on the plans or as directed. Add lime at the percentage determined in Section 2.1.E, "Mix Design." Apply lime only on an area where mixing can be completed during the same working day. Use of quicklime can be dangerous. Inform users of the recommended precautions for handling and storage.
a. Dry Placement. Before applying lime, bring the prepared subgrade to approximately optimum moisture content. When necessary, sprinkle in accordance with. Distribute the required quantity of hydrated lime or pebblegrade quicklime with approved equipment. Only hydrated lime may be distributed by bag. Do not use a motor grader to spread hydrated lime.

b. Slurry Placement. Provide slurry free of objectionable materials, at or above the approved minimum dry solids content, and with a uniform consistency that will allow ease of handling and uniform application. Deliver commercial lime slurry to the jobsite or prepare lime slurry at the jobsite or other approved location by using hydrated lime or quicklime, as specified.

Distribute slurry uniformly by making successive passes over a measured section of roadway until the specified lime content is reached. Uniformly spread the residue from quicklime slurry over the length of the roadway being processed unless otherwise directed.

2. Mixing of Lime. Begin mixing within 6 hr. of lime application. Thoroughly mix the material and lime using approved equipment. Allow the mixture to mellow for 1 to 4 days as directed. When pebble-grade quicklime is used, allow the mixture to mellow for 2 to 4 days as directed. Sprinkle the treated materials during the mixing and mellowing operation, as directed, to achieve adequate hydration and proper moisture content. After mellowing, resume mixing until a homogeneous, friable mixture is obtained.

3. Application of Cement. Uniformly apply cement using dry placement unless otherwise shown on the plans. Add cement at the percentage determined in Section 2.1.E, “Materials.” Apply cement only on an area where mixing, compacting, and finishing can be completed during the same working day.

Start cement application only when the air temperature is at least 35°F and rising or is at least 40°F. The temperature will be taken in the shade and away from artificial heat. Suspend application when the Engineer determines that weather conditions are unsuitable.

a. Dry Placement. Before applying cement, bring the prepared subgrade material to approximately optimum moisture content. When necessary, sprinkle in accordance with. Distribute the required quantity of dry cement with approved equipment. Minimize dust and scattering of cement by wind. Do not apply cement when wind conditions, in the opinion of the Engineer, cause blowing cement to become dangerous to traffic or objectionable to adjacent property owners.

b. Slurry Placement. Mix the required quantity of cement with water, as approved. Provide slurry free of objectionable materials and with a uniform consistency that can be easily applied. Agitate the slurry continuously. Apply slurry within 2 hours of adding water and when the roadway is at a moisture content drier than optimum. Distribute slurry uniformly by making successive passes over a measured section of the roadway until the specified cement content is reached.
4. **Mixing.** Thoroughly mix the material and cement using approved equipment. Mix until a homogeneous mixture is obtained. Sprinkle the treated materials during the mixing operation, as directed, to maintain optimum mixing moisture. Spread and shape the completed mixture in a uniform layer.

After mixing, the Engineer will sample the mixture at roadway moisture and test in accordance with Tex-101-E, Part III, to determine compliance with the gradation requirements in Table 1.

D. **Compaction.** Compact immediately after mixing the last stabilizing agent. Use density control unless otherwise shown on the plans. Complete all compaction operations within 6 hr. of cement application. Multiple lifts are permitted when shown on the plans or approved by the Engineer. Sprinkle the treated material in accordance with TxDOT Item 204, “Sprinkling,” or aerate to bring each layer to the moisture content directed. Determine the moisture content of the mixture at the beginning and during compaction in accordance with Tex-103-E.

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. Offset alternate trips of the roller. Operate rollers at a speed between 2 to 6 MPH as directed.

Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted. Continue work until specification requirements are met. Rework in accordance with a Section 3.1.E, “Reworking a Section.” Perform the work at no additional expense to the Department.

1. **Ordinary Compaction.** Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing treated material as required, reshaping, and re-compacting.

2. **Density Control.** The Engineer will determine density of completed sections in accordance with Tex-115-E. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density. Compact subgrade to at least 95% of the maximum density determined in accordance with Tex-127-E unless otherwise shown on the plans.

E. **Reworking a Section.** Reworking includes loosening, adding material or removing unacceptable material if necessary, mixing as directed, compacting, and finishing. The Contractor has the option of removing failing material and replacing it with acceptable material.

Add lime and cement when reworking lime-cement treated sections at the rate of at least 25% of the percentage determined in Section 2.1.E, “Materials,” as directed. When repulverization of the failing section is not achievable, remove failing material and replace with acceptable treated material.

When density control is specified, determine a new maximum density of the reworked material in accordance with Tex-127-E, and compact in accordance with Section 3.1.D.2, “Density Control.” Compact as directed when ordinary compaction is specified.
F. Finishing. Immediately after completing compaction of the final course, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. When finishing treated base, use a steel wheel roller before rolling with the pneumatic tire roller. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades. Complete finishing operations within 2 hr. after final compaction.

Finished grade tolerances for subgrade will be to within ½-in. in the cross-section and ½-in. in 16-ft. measured longitudinally.

G. Curing. Cure by maintaining in a thorough and continuously moist condition by sprinkling in accordance with. When permitted, cure with an asphalt material applied at a rate of 0.05 to 0.20 gal. per square yard as approved. Do not allow equipment on the finished course during curing except as required for sprinkling, unless otherwise approved.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 37 16.13 Add - RIPRAP

PART 1 GENERAL

1.1 SECTION INCLUDES
Subject to the General and Special Conditions, this section includes requirements for furnishing concrete or stone riprap for common erosion protection applications.

1.2 RELATED SECTIONS
A. 31 05 19.13 – Geotextile
The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES
[None]

1.4 MEASUREMENT AND PAYMENT
A. Subject to Section III, Riprap shall be measured and paid for by the square yard. Payment shall be full compensation for installing the Riprap and include providing all labor, materials, and equipment necessary to complete the geotextile component installation.
   - Riprap Gradation No. 1 when measured by the square yard shall be for a minimum specified thickness of 18 inches, complete in place.
   - Riprap Gradation No. 2 when measured by the square yard shall be for a minimum specified thickness of 24 inches, complete in place. Payment shall be full compensation for providing all labor, materials, excavation and equipment necessary to complete the riprap installation.
B. Excavation for the placement of Riprap Gradation No. 1 to 18 inches below the finish grade or Riprap Gradation No. 2 to 24 inches below the finish grade shall be considered incidental to placement of riprap.
C. Geotextile under the riprap. No separate payment shall be made for Geotextile under Riprap.

1.5 SUBMITTALS
Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.6 DELIVERY, STORAGE AND HANDLING
A. Keep storage area clean, firm, smooth and well drained in order that product can be placed with a minimum of foreign matter.
B. Stockpile and handle material so as to not cause undue segregation of particle sizes either in stockpile, or while loading, hauling and handling.
PART 2 PRODUCTS

2.1 Riprap

A. Provide riprap consisting of broken concrete or stone. Provide riprap that is dense, durable and hard material free from cracks, seams and other defects, which would increase deterioration from handling and natural causes.

B. Shape and Dimensions.

1. Provide riprap in cubic form, rather than elongated (flat) shapes.
2. Provide riprap with a minimum thickness of 6 inches per block.
3. No more than 25 percent may have a length greater than 2-1/2 times width or thickness. No length shall exceed 3 times width or thickness.

C. Do not provide spalls, fragments and chips exceeding 5 percent by weight. Dimension and shape limitations do not apply to this portion of riprap.

D. Where broken concrete is used, cut exposed metal, including rebar and wire mesh, flush with surface prior to placing riprap.

E. Provide riprap conforming to following tables:

Table 1
Riprap Gradation No. 1

<table>
<thead>
<tr>
<th>Percent Lighter by Weight</th>
<th>Stone Lbs.</th>
<th>Weight</th>
<th>Volume Cubic Ft. (2)</th>
<th>Cubical Ft (Each Side)</th>
<th>Spherical Ft (Dia.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower Limit</td>
<td>Upper Limit</td>
<td>Lower Limit</td>
<td>Upper Limit</td>
<td>Lower Limit</td>
</tr>
<tr>
<td>100</td>
<td>180</td>
<td>265</td>
<td>1.20</td>
<td>1.77</td>
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<tr>
<td>50</td>
<td>80</td>
<td>110</td>
<td>0.53</td>
<td>0.73</td>
<td>0.81</td>
</tr>
<tr>
<td>15</td>
<td>40</td>
<td>60</td>
<td>0.27</td>
<td>0.40</td>
<td>0.64</td>
</tr>
</tbody>
</table>

Notes:
1. Theoretical cube and sphere size is presented for guidance only. Paragraph 2.1.B.1 shall control riprap shape and dimensions.
2. Volume is based on 150 pcf, unit weight.
3. Riprap Gradation No. 1 is to be utilized when a riprap mat thickness of 18 inches is required.

Table 2
Riprap Gradation No. 2

<table>
<thead>
<tr>
<th>Percent Lighter by Weight</th>
<th>Stone Lbs.</th>
<th>Weight</th>
<th>Volume Cubic Ft. (2)</th>
<th>Cubical Ft (Each Side)</th>
<th>Spherical Ft (Dia.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower Limit</td>
<td>Upper Limit</td>
<td>Lower Limit</td>
<td>Upper Limit</td>
<td>Lower Limit</td>
</tr>
<tr>
<td>100</td>
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<td>1.33</td>
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<tr>
<td>15</td>
<td>40</td>
<td>150</td>
<td>0.27</td>
<td>1.00</td>
<td>0.64</td>
</tr>
</tbody>
</table>
Notes:
1. Provide a 24-inch thick mat, minimum of Riprap Gradation No. 2.
2. Theoretical cube and sphere size is presented for guidance only. Paragraph 2.1.B.1 shall control riprap shape and dimensions.
3. Volume is based on 150 pcf, unit weight.
4. Riprap Gradation No. 2 is to be utilized only where specifically noted on the drawings.

2.2 GEOTEXTILE
A. Geotextile fabric to be in accordance with Section 31 05 19.13

PART 3 EXECUTION
3.1 Riprap Placement
A. Riprap shall meet gradation and quality requirements prior to placement.
B. Maximum steepness of the side slope, 2 (horizontal) to 1 (vertical).
C. The Construction Manager shall inspect prepared section prior to placing riprap.
D. Install geotextile fabric in accordance with the Plans to the limits of the riprap.
E. Place riprap as shown on the plans to establish a well-graded mass of riprap with minimal voids. Fill voids between larger riprap blocks with spalls and smaller blocks of largest feasible size to form a compact mass. Do not place spalls and small blocks in place of larger size riprap.
F. Individual oversized blocks will not be permitted. Theses shall be broken to acceptable size or removed and replaced with riprap within the gradation limits. Surface irregularities shall be minimal.
G. Minimum riprap mat thickness shall be as shown on the Gradation Tables.
H. Thickness of layer at toe of slope should be increased below the anticipated scour depth (if applicable).
I. Distribute elongated riprap throughout mat.
J. Place riprap to avoid displacement or damage to prepared surface or geotextile. Place riprap in a manner to avoid segregation of particle sizes. Gravel bedding or geotextile fabric required for extensive installations or where warranted by soil conditions.
K. Prevent mixture or incorporation of dirt or other materials with riprap during placement.
L. Do not drop riprap from such a height to cause breakage or to damage the geotextile fabric (if used).
M. Placing of riprap by machine or hand methods shall be permitted provided that the requirements of this Section are obtained.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 41 33.01 Add - TRENCH SAFETY SYSTEM

PART 1  GENERAL
1.1  SECTION INCLUDES
A. Subject to the General and Special Conditions, this Section includes the furnishing of a Trench Excavation and Shoring Safety Plan, including detailed plans and specifications for a trench safety system and requirements for a safety program for the trench system (including a plan for ingress and egress of the trenches, manholes and structures), to be incorporated into the proposal documents and the Construction Contract, and all labor and materials for installation, inspection, and maintenance of trench safety system.

B. Application: For any trench excavation at a depth of 4 feet or greater, provide a trench safety system. Trench safety system is not required when (a) Contractor's geotechnical engineer determines that the trench excavation is to be made in stable rock; or (b) excavations are less than four (4) feet in depth and examination of the ground by a competent person on behalf of the Contractor provides no indication that a cave-in should be expected. Trench safety system to be in accordance with Contractor's Trench Excavation and Shoring Safety Plan, OSHA 2226, OSHA OTM-Section V Chapter 2, latest editions.

C. Modifications: All modifications to the Contractor's Trench Excavation and Shoring Safety Plan or the detailed plans and specifications necessitated by the site conditions, Contractor's trench construction means, methods, techniques or procedures and Contractor's equipment to be used in construction of project facilities to be submitted to the Port Construction Representative. All such modifications to be signed and sealed by a Registered Professional Engineer licensed in the State of Texas and a statement provided stating that the modified plan and/or the modified detailed plans and specifications for the trench safety system are designed in compliance with the Contractor's Standard of Care and is in conformance with appropriate OSHA standards. Such modifications to Contractor's plan and/or the Contractor's detailed plans and specifications for the trench safety system to thereafter be incorporated into the Construction Contract.

1.2  RELATED SECTIONS

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3  REFERENCES
A. American Society of Testing and Materials (ASTM):
5. ASTM A588/A588M - 1997 Standard Specification for High-Strength Low-Alloy Structural Steel With 50 ksi (345 MPa) Minimum Yield Point to 04 in. (100 mm) thick.


B. American Welding Society, Inc. (AWS):

C. Occupation Safety and Health Administration (OSHA):
   1. 29 CFR Part 1926 - 1993 (Revised as of July 1, 1996 or latest Edition or revision to) Subpart P Excavations and Applicable Subparts.
   2. OSHA 2226 - 2002 Excavations.

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, The design and installation of the trench safety system shall be measured and paid for by the linear foot of trench protected. Shoring of trench at manholes and other line structures shall be included in the linear foot cost.

B. There will be no increase in the Contract price resulting from the incorporation of the Contractor’s Trench Excavation and Shoring Safety Plan or Contractor’s detailed plans and specifications for the trench safety system into the proposed Contract Documents. There will be no increase in the Contract price resulting from modifications to the Contractor’s plan and/or the Contractor’s detailed plans and specifications for the trench safety system, whether or not the result of unforeseen or differing site or soil conditions.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The successful Contractor to submit its Proposed Trench Excavation and Shoring Safety Plan 10 days after Purchase Order date. The plan to incorporate detailed PLANS and SPECIFICATIONS for a trench safety system conforming to OSHA standards that accounts for project site conditions, Contractor’s trench construction means, methods, techniques or procedures, the relationship of spoil to edge of trench, and Contractor’s equipment to be used in construction of project facilities requiring trench system(s). Contractor to provide a statement signed and sealed by a Registered Professional Engineer licensed in the State of Texas stating that the Trench Excavation and Shoring Safety Plan and the detailed plans and specifications for the trench safety system are designed in compliance with the Contractor’s Standard of Care and is in conformance with appropriate OSHA standards. Contractor is to carry out trench safety as outlined in his Shoring Safety Plan. Any modifications to his Plan are to be re-submitted with a new sealed statement from a Registered Engineer in the State of Texas.

1.6 QUALITY ASSURANCE

Trench safety systems to be accomplished in accordance with the detailed Specifications set out in the provisions 29 CFR, Part 1926, Subpart P, and the Texas Health and Safety Code Chapter 756.022 and 023 with regard to Trench Safety Systems, is also hereby incorporated, by reference, into these Specifications.
PART 2  PRODUCTS

2.1 Materials And/Or Equipment

A. Timber: Trench sheeting materials to be full size, a minimum of 2 inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.

B. Sheet Piling: Steel sheet piling to conform to one or more of ASTM A328, ASTM A572, ASTM A690 material requirements.

C. Steel for stringers (wales) and cross braces to conform to ASTM A588.

D. Steel trench boxes to be constructed of steel conforming to ASTM A36. Connecting bolts to conform to ASTM A307. Welds to conform to the requirements of AWS D1.1.

E. Miscellaneous Materials: Miscellaneous materials to be utilized to conform to applicable ASTM standards.

PART 3  EXECUTION

3.1 General

A. Trench safety system to be constructed, installed, and maintained in accordance with the Trench Excavation and Shoring Safety Plan as outlined in Paragraph 3.5A of this Section.

3.2 Erection/Installation/Application And/Or Construction

A. Timber Sheeting: Timber sheeting and size of uprights, stringers (wales), and cross bracing to be installed in accordance with the Contractor’s plan. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling, or kickouts. Cross braces to be placed at each end of stringers (wales), in addition to other locations required. Cross braces and stringers (wales) to be placed at splices of uprights, in addition to other locations required.

B. Steel Sheet Piling: Steel sheet piling of equal or greater strength may be used in lieu of timber trench shoring shown in the OSHA tables (proposed standards). Drive steel sheet piling to at least minimum depth below trench bottom as recommended by Contractor’s Registered Professional Engineer providing design. Place cross braces in true horizontal position, spaced vertically and secured to prevent sliding, falling, or kickouts. Cross braces to be placed at each end of stringers (wales), in addition to other locations required.

C. Trench Boxes: Portable trench box may be used in lieu of timber trench shoring shown in the OSHA tables and to be designed to provide equal or greater protection than timber trench shoring shown in the OSHA tables. In cases where top of portable trench box will be below top of trench, the trench must be sloped to the maximum allowable slope for the soil conditions existing on the Project. In areas where a sloped trench will affect the integrity of existing structures, Contractor to protect structures prior to sloping trench.

D. Trench Jacks: When trench jacks are used for cross bracing and/or stringers (wales), the trench jacks to provide protection greater than or equal to the timber cross bracing shown in the OSHA tables (proposed standards). Trench jacks to be placed at each end of stringers (wales) in addition to other locations required.

3.3 Repair/Restoration

A. Bed and backfill pipe to a point at least one (1) foot above top of pipe or other embedded items prior to removal of any portion of trench safety system. Bedding and backfill to be in accordance with other applicable specification Sections.
B. Backfilling and removal of trench supports to be in accordance with Contractor’s Trench Excavation and Shoring Safety Plan. Removal of trench safety system to be accomplished in such a manner to cause no damage to pipe or other embedded items. Remove no braces or trench supports until all personnel have evacuated the trench. Backfill trench to within 4 feet of natural ground prior to removal of entire trench safety system.

3.4 Field Quality Control

A. Supervision: Provide competent supervisory personnel at each trench while work is in progress to ensure Contractor’s methods, procedures, equipment, and materials pertaining to the safety systems in this Section are sufficient to meet requirements of OSHA Standards.

B. Inspection: Contractor to make daily, before the start of each shift, and the end of each rainstorm inspection of the trench safety system to ensure that the system meets OSHA requirements. Inspection to be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench is to cease until necessary precautions have been taken to safeguard personnel entering trench. Contractor to maintain permanent record of daily inspections on site, available to the Port Construction Representative.

C. Hazardous Conditions: Contractor shall use a trained, certified and competent person to make daily checks for hazardous atmosphere of all excavations 4 feet or deeper. Contractor must provide employee controls such as respiratory protection/ventilation adjacent to any trench being worked in. Contractor must ensure personnel are trained in equipment use and potential hazards.

3.5 Protection

A. Maintenance of Safety System: The safety system to be maintained in the condition as shown on the Trench Excavation and Shoring Safety Plan as designed by the Contractor’s Registered Professional Engineer. The Contractor to take all necessary precaution to ensure the safety systems are not damaged during their use. If at any time during its use a safety system is damaged, personnel to be immediately removed from the trench excavation area and the safety system repaired. The Contractor is to take all necessary precautions to ensure no loads, except those provided for in the plan, are imposed upon the trench safety system.

B. Removal: Back filling and removal of trench supports shall progress together from the bottom of the trench upward. Remove no trench safety system component until all personnel have evacuated the trench.

C. Means of Egress: Means of egress from trench excavations. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 31 41 33.02 Add - TRENCH SAFETY ATTACHMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to General and Special Conditions, The following is reproduced from the 29CFR, Part 1926, Subpart P - Excavations, Trenching and Shoring, July 1, 1987 Edition, for the convenience of the Contractor.

1. Subpart P - Excavations, Trenching, and Shoring:

a. 1926.650 General Protection Requirements.

1) Walkways, runways, and sidewalks shall be kept clear of excavated material or other obstructions and no sidewalks shall be undermined unless shored to carry a minimum live load of one hundred and twenty-five (125) pounds per square foot.

2) If planks are used for raised walkways, runways, or sidewalks, they shall be laid parallel to the length of the walk and fastened together against displacement.

3) Planks shall be uniform in thickness and all exposed ends shall be provided with beveled cleats to prevent tripping.

4) Raised walkways, runways, and sidewalks shall be provided with plank steps on strong stringers. Ramps, used in lieu of steps, shall be provided with cleats to ensure a safe walking surface.

5) All employees shall be protected with personal protective equipment for the protection of the head, eyes, respiratory organs, hands, feet, and other parts of the body as set forth in Subpart E of this part.

6) Employees exposed to vehicular traffic shall be provided with and shall be instructed to wear warning vests marked with or made of reflectorized or high visibility material.

7) Employees subjected to hazardous dusts, gases, fumes, mists, or atmospheres deficient in oxygen, shall be protected with approved respiratory protection as set forth in Subpart D of this part.

8) No person shall be permitted under loads handled by power shovels, derricks, or hoists. To avoid any spillage employees shall be required to stand away from any vehicle being loaded.

9) Daily inspections of excavations shall be made by a competent person. If evidence of possible cave-ins or slides is apparent, all work in the excavation shall cease until the necessary precautions have been taken to safeguard the employees.

1.2 RELATED SECTIONS

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

[None]
1.4 MEASUREMENTS AND PAYMENTS
A. Subject to Section III, there will be no separate payment for trench safety or shoring under this item. Include costs in item(s) 31 41 33.01.

1.5 SUBMITTALS
Contractors shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.6 1926.651 SPECIFIC EXCAVATION REQUIREMENTS
A. Prior to opening an excavation, effort shall be made to determine whether underground installations, i.e., sewer, telephone, water, fuel, electric lines, etc., will be encountered, and if so, where such underground installations are located. When the excavation approaches the estimated location of such an installation, the exact location shall be determined and when it is uncovered, proper supports shall be provided for the existing installation. Utility companies shall be contacted and advised of proposed work prior to the start of actual excavation.

B. Trees, boulders, and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, shall be removed or made safe before excavating is begun.

C. The walls and faces of all excavations in which employees are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground, or some other equivalent means.

D. Excavations shall be inspected by a competent person after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.

E. The determination of the angle of repose and design of the supporting system shall be based on careful evaluation of pertinent factors such as: Depth of cut; possible variation in water content of the material while the excavation is open; anticipated changes in materials from exposure to air, sun, water, or freezing; loading imposed by structures, equipment, overlying material, or stored material; and vibration from equipment, blasting, traffic, or other sources.

F. Supporting systems, i.e., piling, cribbings, shoring, etc., shall be designed by a qualified person and meet accepted engineering requirements. When tie rods are used to restrain the top of sheeting or other retaining systems, the rods shall be securely anchored well back of the angle of repose. When tight sheeting or sheet piling is used, full loading due to ground water table shall be assumed, unless prevented by weep holes or drains or other means. Additional stringers, ties, and bracing shall be provided to allow for any necessary temporary removal of individual supports.

G. All slopes shall be excavated to at least the angle of repose except for areas where solid rock allows for line drilling or pre-splitting.

H. The angle of repose shall be flattened when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action, and slide planes appear.
   1. In excavations which employees may be required to enter, excavated or other material shall be effectively stored and retained at least 2 feet or more from the edge of the excavation.
   2. As an alternative to the clearance prescribed in item above of this section, the employer may use effective barriers or other effective retaining devices in lieu thereof in order to prevent excavated or other materials from falling into the excavation.
I. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Special attention shall be given to slopes which may be adversely affected by weather or moisture content.

J. Support systems shall be planned and designed by a qualified person when excavation is in excess of 20 feet in depth, adjacent to structures or improvements, or subject to vibration or ground water.

K. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, and underpinning shall be in good serviceable condition, and timbers shall be sound, free from large or loose knots, and of proper dimensions.

L. Special precautions shall be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or a fill, particularly when the separation is less than the depth of the excavation. Particular attention also shall be paid to joints and seams of material comprising a face and the slope of such seams and joints.

M. Except in hard rock, excavations below the level of the base of footing of any foundation or retaining wall shall not be permitted, unless the wall is underpinned and all other precautions taken to ensure the stability of the adjacent walls for the protection of employees involved in excavation work or in the vicinity thereof.

N. If the stability of adjoining buildings or walls is endangered by excavations, shoring, bracing, or underpinning shall be provided as necessary to ensure their safety. Such shoring, bracing, or underpinning shall be inspected daily or more often, as conditions warrant, by a competent person and the protection effectively maintained.

O. Diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Water shall not be allowed to accumulate in an excavation.

P. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above and near an excavation, the side of the excavation shall be sheet-piled, shored, and braced as necessary to resist the extra pressure due to such superimposed loads.

Q. When mobile equipment is utilized or allowed adjacent to excavations, substantial stop logs or barricades shall be installed. If possible, the grade should be away from the excavation.

R. Adequate barrier physical protection shall be provided at all remotely located excavations. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be backfilled.

S. In locations where oxygen deficiency or gaseous conditions are possible, air in the excavation shall be tested. Controls shall be established to assure acceptable atmospheric conditions. When flammable gases are present, adequate ventilation shall be provided or sources of ignition shall be eliminated. Attended emergency rescue equipment, such as breathing apparatus, a safety harness and line, basket stretcher, etc., shall be readily available where adverse atmospheric conditions may exist or develop in an excavation.

T. Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails shall be provided. Kickboards shall be placed on all walkways above work areas.

U. Where ramps are used for employees or equipment, they shall be designed and constructed by qualified persons in accordance with accepted engineering requirements.

V. All ladders used on excavation operations shall be in accordance with the requirements of Subpart L of this part.
1.7 1926.652 SPECIFIC TRENCH REQUIREMENTS

A. Banks more than 5 feet high shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided where employees may be exposed to moving ground or cave-ins. Refer to Table P-1 as a guide in sloping of banks. Trenches less than 5 feet in depth shall also be effectively protected when examination of the ground indicates hazardous ground movement may be expected.

B. Sides of trenches in unstable or soft material, 5 feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect the employees working within them. See Tables P-1, P-2 (following Paragraph (g) of this section).

C. Sides of trenches in hard or compact soil, including embankments, shall be shored or otherwise supported when the trench is more than 5 feet in depth and 8 feet or more in length. In lieu of shoring, the sides of the trench above the 5-foot level may be sloped to preclude collapse, but shall not be steeper than a 1-foot rise to each 1/2-foot horizontal. When the outside diameter of a pipe is greater than 6 feet, a bench of 4-foot minimum shall be provided at the top of the sloped portion.

D. Materials used for sheeting and sheet piling, bracing, shoring, and underpinning, shall be in good serviceable condition, and timbers used shall be sound and free from large or loose knots, and shall be designed and installed so as to be effective to the bottom of the excavation.

E. Additional precautions by way of shoring and bracing shall be taken to present slides or cave-ins when excavations or trenches are made in locations adjacent to backfilled excavations, or where excavations are subjected to vibrations from railroad or highway traffic, the operation of machinery, or any other source.

F. Employees entering bell-bottom pier holes shall be protected by the installation of a removable-type casing of sufficient strength to resist shifting of the surrounding earth. Such temporary protection shall be provided for the full depth of that part of each pier hole which is above the bell. A lifeline, suitable for instant rescue and securely fastened to a shoulder harness, shall be worn by each employee entering the shafts. This lifeline shall be individually manned and separate from any line used to remove materials excavated from the bell footing.

   1. Minimum requirements for trench timbering shall be in accordance with Table P-2.

   2. Braces and diagonal shores in a wood shoring system shall not be subjected to compressive stress in excess of values given by the following formula:

      \[ S = 1300 - 20L/D \]

      Maximum ratio L/D=50

      Where:

      L = Length, unsupported, in inches.
      D = Least side of the timber in inches.
      S = Allowable stress in pounds per square inch of cross-section.

G. When employees are required to be in trenches 4 feet deep or more, an adequate means of exit, such as a ladder or steps, shall be provided and located so as to require no more than 25 feet of lateral travel.

H. Bracing or shoring of trenches shall be carried along with the excavation.

I. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling, or kickouts.
Portable trench boxes or sliding trench shields may be used for the protection of personnel in lieu of a shoring system or sloping. Where such trench boxes or shields are used, they shall be designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheeting or shoring required for the trench.

Backfilling and removal of trench supports shall progress together from the bottom of the trench. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

1.8 1926.653 DEFINITIONS APPLICABLE TO THIS SUBPART

A. Accepted Engineering Requirements (or Practices): Those requirements or practices which are compatible with standards required by a registered architect, a registered professional engineer, or other duly licensed or recognized authority.

B. Angle of Repose: The greatest angle above the horizontal plane at which a material will lie without sliding.

C. Bank: A mass of soil rising above a digging level.

D. Belled Excavation: A part of a shaft or footing excavation, usually near the bottom and bell-shaped, i.e., an enlargement of the cross section above.

E. Braces (Trench): The horizontal members of the shoring system whose ends bear against the uprights or stringers.

F. Excavation: Any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.

G. Faces: See Paragraph “Sides,” “Walls,” or “Fans” of this section.

H. Hard Compact Soil: All earth materials not classified as running or unstable.

I. Kickouts: Accidental release or failure of a shore or brace.

J. Sheet Pile: A pile, or sheeting, that may form one of a continuous interlocking line, or a row of timber, concrete, or steel piles, driven in close contact to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials.

K. Sides, Walls, or Faces: The vertical or inclined earth surfaces formed as a result of excavation work.

L. Slope: The angle with the horizontal at which a particular earth material will stand indefinitely without movement.

M. Stringers (Wales): The horizontal members of a shoring system whose sides bear against the uprights or earth.

N. Trench: A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.

O. Trench Jack: Screw or hydraulic type jacks used as cross bracing in a trench shoring system.

P. Trench Shield: A shoring system composed of steel plates and bracing, welded or bolted together, which support the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.

Q. Unstable Soil: Earth material, other than running, that because of its nature or the influence of related conditions, cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.
R. Uprights: The vertical members of a shoring system.
S. Wales: See Paragraph Stringers of this section.
T. Walls: See Paragraph “Sides,” “Walls,” or “Faces” of this section.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 11 33.00 Add - CEMENT-TREATED BASE COURSE

PART 1 DESCRIPTION

1.1 SECTION INCLUDES

A. Subject to General and Special Conditions, this section includes a base course composed of recycled crushed concrete or crushed stone and cement uniformly blended and mixed with water. The mixed material shall be spread, shaped, and compacted in accordance with these specifications and in conformity to the lines, grades, dimensions, and typical cross sections shown on the Plans. Pavements shall be built in a series of parallel lanes using a plan of processing that reduces longitudinal and transverse joints to a minimum.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.3 MEASUREMENT AND PAYMENT

A. Cement treated base shall be measured by the Square Yard of surface area of completed and accepted base at the thickness indicated in the plans. The limits of measurement for cement treated base shall be to the limits as shown on the plans. Additional cement treated base outside the limits for the Contractor’s convenience shall not be measured for payment.

B. The quantity of cement treated base measured as set out above shall be paid for at the unit price for “Cement Treated Base Course”, which price shall be full compensation for shaping and fine grading the underlying pavement course; for furnishing and placing of cement in the base; and for all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work.

C. There will be no separate payment for asphaltic cure coat, emulsified asphalt prime coat.

D. There will be no separate payment for cement.

PART 2 MATERIALS

2.1 PORTLAND CEMENT. Portland cement shall conform to the requirements of ASTM C 150 Type I.

2.2 WATER. Water shall be clean, clear, and free from injurious amounts of sewage, oil, acid, strong alkalies, or vegetable matter, and it shall be free from clay or silt. If the water is of questionable quality, it shall be tested in accordance with the requirements of AASHTO T 26.

2.3 AGGREGATE. The aggregate shall be select granular materials meeting the gradation requirements given in Table 1 when tested in accordance with ASTM C 136. Concrete sand may be added to the mix to provide required gradation and PI. The material shall be free of roots, sod,
and weeds. The crushed or uncrushed aggregate shall consist of hard, durable particles of accepted quality, free from an excess of flat, elongated, soft, or disintegrated pieces, or objectionable matter. The method used in producing the aggregate shall be such that the finished product shall be as consistent as practicable. All stones and rocks of inferior quality shall be wasted.

### TABLE 1. AGGREGATE FOR CEMENT-TREATED BASE COURSE

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by Weight Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/4 in. (45 mm)</td>
<td>100</td>
</tr>
<tr>
<td>7/8 in. (22 mm)</td>
<td>10-35</td>
</tr>
<tr>
<td>3/8 in. (22 mm)</td>
<td>30-50</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>45-65</td>
</tr>
<tr>
<td>No. 40 (425 μm)</td>
<td>70-85</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Limit</td>
<td>35% Maximum</td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>10% Maximum</td>
</tr>
</tbody>
</table>

Aggregates suspected of containing injurious quantities of sulfates shall be examined petrographically in accordance with ASTM C 295.

The gradations in the table represent the limits which shall determine suitability of aggregate for use from the sources of supply. The final gradations decided on, within the limits designated in the table, shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on adjacent sieves, or vice versa. The portion of the base aggregate, including any blended material, passing the No. 40 sieve shall have a liquid limit of not more than 35 and a plasticity index of not more than 10 when tested in accordance with ASTM D 4318.

All aggregate samples required for testing shall be furnished by the Contractor at the expense of the Contractor. Sampling shall be in accordance with ASTM D 75 and will be observed by the Engineer. No aggregate shall be used in production of mixtures without prior approval.

### 2.4 BITUMINOUS MATERIAL

The types, grades, and controlling specifications and application temperatures for the bituminous material are given in Table 2.

### TABLE 2. BITUMINOUS MATERIAL FOR PRIME COAT

<table>
<thead>
<tr>
<th>Type and Grade</th>
<th>Specification</th>
<th>Application Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emulsified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-1, SS-1</td>
<td>ASTM D 977</td>
<td>75-130 Deg. F 25-55 Deg. C</td>
</tr>
<tr>
<td>CRS-1</td>
<td>ASTM D 2397</td>
<td>75-130 Deg. F 25-55 Deg. C</td>
</tr>
</tbody>
</table>

### PART 3 CEMENT CONTENT

3.1 Prior to start of work, laboratory tests of materials submitted by the Contractor shall be made to determine the quantity of cement required in the mix. The cement content for construction shall be that at which the mix develops a 7-day unconfined compressive strength of at least 500 psi (3450 kPa). The testing procedure shall be as follows: mold and cure specimens in accordance
with Tex-120-E, “Soil Cement Testing”. After 7-day cure soak specimens in water for 4 hours then cap and break specimens in compression in accordance with ASTM D 1633, modified to allow the use of high-strength plaster in lieu of sulfur caps.

If during the production of cement treated base it is determined that the material source(s) have changed, a new determination of the cement content will be make by the contractor. The mix design will be submitted to show that the material still meets the strength requirements.

PART 4 CONSTRUCTION METHODS

4.1 WEATHER LIMITATIONS. The cement-treated base shall not be mixed or placed while the atmospheric temperature is below 40°F (4°C) or when conditions indicate that the temperature may fall below 35°F (2°C) within 24 hours or when the weather is rainy or rain is forecasted prior to completion of the days planned installation. Cement-treated base shall not be placed on frozen subgrade or mixed when aggregate is frozen.

4.2 OPERATION AT PITS. All work involved in clearing and stripping pits, including handling unsuitable material, shall be performed by the Contractor. The Contractor shall notify the Engineer sufficiently in advance of opening of any designated pit to permit staking of boundaries at the site, to take elevations and measurements of the ground surface before material is produced, to permit the Engineer to take samples of the material for tests to determine its quality and gradation, and to prepare a preliminary design of base mixture.

The pits, as utilized, shall be opened immediately to expose vertical faces of the various strata of acceptable material and, unless otherwise directed, the material shall be secured in successive vertical cuts extending through all the exposed strata in order to secure a uniform material.

4.3 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected before the base course is placed thereon.

4.4 MIXING. The aggregate shall be proportioned and mixed with cement and water in a central mixing plant or pug mill. The plant shall be equipped with feeding and metering devices which will introduce the cement, aggregate, and water into the mixer in the quantities specified. The moisture content of the mixture shall not be more than 2 percentage points outside the optimum moisture content at the start of compaction. The optimum moisture content shall be determined in accordance with TEX-120-E. Mixing shall continue until a thorough and uniform mixture has been obtained.

4.5 PLACING. The mixture shall be transported to the job site in suitable vehicles and shall be deposited on the moistened subbase in uniform layers by means of approved mechanical spreaders. Not more than 60 minutes shall elapse between the start of moist mixing and the start of compaction of the cement-treated mixture on the prepared subgrade. Any mixture that has not been compacted shall not be left undistributed for more than 30 minutes.

A. In single layer construction, complete compaction of layer within 3 hours of the start of moist mixing.

B. In multilayer construction, the surface of the compacted underlying base material shall be kept moist until covered with the next layer. Successive layers shall be placed and compacted so that compaction of top layer is completed within 5 hours after the start of moist mixing of the bottommost layer. For multilayer construction the required total depth of the base is to be completed the same day.
4.6 ACCEPTANCE SAMPLING AND TESTING OF CEMENT-TREATED BASE COURSE (COMPACTION). Immediately upon completion of the spreading operations, the mixture shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density.

The cement-treated base course shall be accepted for density on a lot basis. A lot will consist of 1,000 square yards or one day’s production, whichever is less, and will be divided into four equal sublots. One test shall be made for each sublot. Sampling locations will be determined by the Engineer on a random basis in accordance with statistical procedures contained in ASTM D 3665.

Each lot of compacted material will be accepted, with respect to density, when the average field density is equal to or greater than 96 percent of the maximum density of laboratory specimens prepared from samples of cement-treated base course taken from the material in place.

The laboratory specimens shall be compacted and tested in accordance with TEX-113-E. Nuclear gage will be allowed for in-place density and moisture tests in accordance with ASTM D 2922 and ASTM D 3017; however, the in-place field density shall be determined in accordance with ASTM D 1556 or ASTM D 2167 for every 10 nuclear gage measurements.

Additionally, the Port of Houston reserves the right to accept material based on strength. When determined to be tested by the Port of Houston, strength acceptance will be based on testing of cored material, tested in accordance with ASTM D 1633 to a strength of no less than 85% of the strength listed in paragraph 3.1. Materials that do not meet the strength as outlined in paragraph 3.1 above are to be removed and replaced at no additional cost to the Port of Houston.

4.7 LAYER THICKNESS. The maximum depth of a compacted layer shall be 6 inches (150 mm), except where that total depth of the compacted base course is required to be greater than 6 inches (150 mm), no layer shall be in excess of 8 inches (200 mm) or less than 4 inches (100 mm) when compacted.

4.8 FINISHING. Finishing operations shall be completed during daylight hours, and the completed base course shall conform to the required lines, grades, and cross section. If necessary, the surface shall be lightly scarified to eliminate any imprints made by the compacting or shaping equipment. The surface shall then be recompacted to the required density within the time allotted in paragraph 4.5. The compaction and finishing operations shall be completed to produce a smooth, dense surface that is free of surface checking, ridges, or loose material.

4.9 SURFACE TOLERANCE. The finished surface shall not vary more than 1/4 inch (6 mm) when tested with a 10-foot (3.0 m) straightedge applied parallel with, or at right angles to, the centerline of the stabilized area. Any deviation in excess of this amount shall be corrected by the Contractor at the Contractor’s expense.

4.10 CONSTRUCTION JOINTS. At the end of each day’s construction, a transverse construction joint shall be formed by a header or by cutting back into the compacted material to form a true vertical face free of loose material.

Longitudinal joints shall be formed by cutting back into the compacted material to form a true vertical edge.

4.11 PROTECTION AND CURING. The completed cement-treated base shall be cured with a bituminous curing prime coat per section 2.4 applied as soon as possible and in no case later than 24 hours after completion of the finishing operations. The surface of the base course shall be kept moist until the curing seal is applied.
Bituminous material shall be uniformly applied at a rate of between 0.10 and 0.25 gallons per square yard (0.47 and 1.20 liters per square meter) of surface. The rate of application shall be approved by the Engineer. There will be no separate payment for cure coat.

The curing seal shall be maintained and protected for 7 days.

Finished portions of the base course that are used by equipment in the construction of an adjoining section shall be protected to prevent marring or damaging the completed work. The stabilized area shall be protected from freezing during the curing period.

**PART 5  TESTING REQUIREMENTS**

- ASTM C 136  Sieve or Screen Analysis of Fine and Coarse Aggregate
- ASTM C 295  Petrographic Examination of Aggregates for Concrete
- ASTM D 75  Sampling Aggregates
- ASTM D 560  Freezing-and-Thawing Tests of Compacted Soil-Cement Mixtures
- ASTM D 1556  Density of Soil in Place by the Sand-Cone Method
- ASTM D 1633  Compressive Strength of Molded Soil-Cement Cylinders
- ASTM D 2167  Density of Soil in Place by the Rubber-Balloon Method
- ASTM D 3665  Random Sampling of Paving Materials
- ASTM D 4318  Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- AASHTO T 26  Quality of Water to be Used in Concrete
- ASTM D 2922  Test for Density of Soil and Soil-Aggregate in Place by Nuclear Method
- ASTM D 3017  Test Method for Water Content of Soil and Rock in Place by Nuclear Method
- Tex-113-E  Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials
- Tex-120-E  Soil Cement Testing

**MATERIAL REQUIREMENTS**

- ASTM C 150  Portland Cement
- ASTM C 595  Blended Hydraulic Cements
- ASTM D 977  Emulsified Asphalt
- ASTM D 2397  Cationic Emulsified Asphalt

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 11 45.00 Add - DRAINAGE LAYER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the installation of the sub-surface pavement drainage system. This item consists of a drainable base course composed of a poorly graded crushed aggregate constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross sections shown on the plans.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, the quantity of "#57 Stone Drainage Layer" shall be measured for payment by the number of Square Yards at the depth indicated, installed and accepted. The dimensions for determining the surface area is established by the widths and the lengths measured at placement, and as indicated on the Plans, complete in place and accepted. Additional area(s) of placement of stone drainage layer for the Contractor's convenience will not be measured for payment.

B. Payment shall be based on accepted in place drainage layer to the dimensions indicated on the plans. No separate payment shall be made for the highway edge drain, sleeve, or incidentals to be installed adjacent/through the trench drain walls.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C 29 Unit Weight of Aggregate

2. ASTM C 88 Magnesium Sulfate Soundness of Aggregates by Use of Sodium Sulfate

3. ASTM C 117 Materials Finer than 75um (No. 200) Sieve in Mineral Aggregates by Washing

4. ASTM C 131 Aggregate by Resistance to Abrasion of Small Size Coarse Use of the Los Angeles Machine

5. ASTM C 136 Aggregate Sieve or Screen Analysis of Fine and Coarse
6. ASTM D 75  
Sampling Aggregate

7. ASTM D 693  
Crushed Stone, Crushed Slag, and Crushed Gravel for Dry-or Water-Bound Macadam Base Courses and Bituminous Macadam Base and Surface Courses of Pavements.

8. ASTM C 33  
Concrete Aggregates.

9. ASTM D 3665  
Random Sampling of Paving Materials

10. ASTM D 698  

11. ASTM D 2922  
Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

12. ASTM D 3017  
Test Method for Water Content of Soil and Soil Rock in Place by Nuclear Methods.

13. TxDOT Tex-413-A  
Determining Deleterious Material in Mineral Aggregate

PART 2 PRODUCTS

2.1 SUBMITTALS

1. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

2. Product Data: Submit test results indicating the materials meet the gradation specified herein or certification of compliance by vendor.

2.2 MATERIALS

A. Aggregates shall consist of clean, sound, durable particles of crushed stone and shall be free from coatings of clay, silt, vegetable matter, and other objectionable materials and shall contain no clay balls. Fine aggregate passing the No. 4 (4.75 mm) sieve shall consist of fines from the operation of crushing the coarse aggregate.

B. The crushed aggregate portion which is retained on the No. 4 (4.75 mm) sieve shall contain not more than 15 percent, by weight, of flat or elongated pieces as defined in ASTM D 693 and shall have at least 90 percent by weight of particles with at least two fractured faces and 100 percent with at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

C. The percentage of wear shall not be greater than 45 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 12 percent, after 5 cycles, when tested in accordance with ASTM C 88.

D. Sampling and Testing. Aggregates for preliminary testing shall be furnished by the Contractor prior to the start of production. All tests for initial aggregate
submittals necessary to determine compliance with the specification requirements will be
made by the Engineer at no expense to the Contractor. Samples of aggregates shall be
furnished by the Contractor at the start of production and at intervals during production.
The sampling points and intervals will be designated by the Engineer. The samples will
be the basis of approval of specific lots of aggregates from the standpoint of the quality
requirements of this section.

In lieu of testing, the Engineer may accept certified state test results indicating that the
aggregate meets specification requirements. Samples of aggregates to check gradation
shall be taken by the Engineer at least once daily. Sampling shall be in accordance with
ASTM D 75, and testing shall be in accordance with ASTM C 136 and C 117.

E. Gradation Requirements. The gradation of the crushed stone shall be Grade No. 57
conforming to ASTM C 33 with the following modifications. The gradation shall be as
follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>% Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2”</td>
<td>100</td>
</tr>
<tr>
<td>1”</td>
<td>95 – 100</td>
</tr>
<tr>
<td>1/2”</td>
<td>25 – 60</td>
</tr>
<tr>
<td>No. 4</td>
<td>0 – 10</td>
</tr>
<tr>
<td>No. 8</td>
<td>0 – 5</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 – 2</td>
</tr>
</tbody>
</table>

F. Mixed Materials shall meet the following requirements:

I. Minimum compressive strength of 35 psi at 0 psi lateral pressure and 175 at 15 psi lateral
   pressure using triaxial testing procedures.

G. Recycled Material (Including Crushed Concrete) Requirements

1. Recycled material must be free from reinforcing steel and other objectionable material and
   have at most 1.5% deleterious material when tested in accordance with Tex-413-A.

PART 3 EXECUTION

3.1 PLACEMENT, COMPACTION, TESTING, ACCEPTANCE

A. The aggregate shall be uniformly blended during construction operations or blended in a
   plant. The crushed aggregate shall be placed on the prepared subgrade that has been
   covered by an appropriate geotextile layer to prevent contamination of the crushed stone
   with subgrade fine materials. Contractor is to avoid placing un-necessary vehicle traffic
   on installed geotextile. The crushed stone shall be placed on the geotextile and spread
   with a mechanical spreader. Spread and shape in lift to compacted thickness not to
   exceed 6 inches in depth. Complete spreading, shaping, and compacting on same day
   material is deposited.

B. Place based so that projecting reinforcing steel from curbs remain at approximate center
   of base. Secure a firm bond between reinforcement and base.

C. Start rolling operations as soon as possible after placement. Use sheepfoot, steel, or
   pneumatic rollers as approved. Roll longitudinally with subgrade starting from sides.
Overlap successive strips by one-half width of each rear wheel. The spread layer of material shall be lightly rolled with a flat-drum roller to compact. Avoid excessive rolling to reduce crushing of the placed material.

D. Maintain moisture between optimum and plus or minus 2% (percent) above optimum moisture.

E. Compact to 95 percent of Proctor density in accordance with ASTM D 698, unless otherwise indicated on the Drawings.

F. Compact using density control unless otherwise shown on the plans. Multiple lifts are permitted when shown on the plans or approved. Bring each layer to the moisture content directed. Sprinkle the material as necessary to achieve open compaction. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least ½ the widths of the roller unit. On super elevated curves, begin rolling at the low side and progress toward the high side. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph as directed. Rework, recompact and refinish material that fails to meet or that loses required moisture, density, stability or finish before the next course is placed or the project is accepted. Continue work until specification requirements are met. Correct irregularities, depressions and weak spots immediately by scarifying the areas affected, adding or removing approved material as required, reshaping, and recompacting.

G. Finish to grade and compact lift before placing successive lift.

H. After completing compaction, clip, skin or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately ¼ in. Removed loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling the pneumatic tire roller until a smooth surface is attained. Add small increments or water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines and grades as shown on the plans or as directed.

I. Maintain shape by grading throughout operation.

J. Testing for thickness control will require that the finished surface shall not vary more than 3/8-in. when tested with a 16-ft. straight edge applied parallel with or at right angles to the centerline of the east-west direction. Any deviation in excess of this amount shall be corrected by the Contractor at the Contractor’s expense.

K. Provide total thickness indicated on Drawings.

L. Acceptance will be on a lot basis. A lot will consist of one day’s production where it is not expected to exceed 2,000 square yards. A lot will consist of one-half day’s production where a day’s production is expected to consist of between 2,000 and 4,000 square yards. The completed thickness of the drainage layer shall be within ½-in. of the design thickness. Four determinations of thickness shall be made for each lot of material placed. The lot size shall be as cited herein. Each lot shall be divided into four equal sub-lots with one thickness measurement in each sub-lot. Sampling locations will be determined by the Engineer on a random basis in accordance with procedures contained in ASTM 3665, ASTM D 698, or ASTM D 2922 and ASTM D 3017. Where thickness is deficient by more than ½-in, the Contractor shall correct such areas at no additional cost. Additional tests may be required to define the limits of deficient areas.
M. Contractor is to take care to protect the surface of installed crushed stone by avoiding activities that may crush or disturb placed material. Contractor is to avoid placing unnecessary vehicle traffic on installed crushed stone layer.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 12 16.00 Add – HOT MIX ASPHALTIC PAVEMENT

PART 1 DESCRIPTION

1.1 SECTION INCLUDES

A. Subject to the requirements of the General and Special Conditions, this Item shall govern the construction of hot mix asphaltic concrete pavement on previously prepared subgrade or base courses and the patching of pavements and surfaces, all as shown on the Drawings and specified herein.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance to the requirement of the General and Special Conditions.

1.3 MEASUREMENT AND PAYMENT

A. MEASUREMENT

1. Subject to Section III, the quantity of asphaltic concrete shall be calculated from the thickness of asphaltic concrete designated on the Drawings and plan areas measured in the field. The weight of material in such method of quantity calculation shall be on the basis of 110 pounds per square yard per inch of depth of asphaltic concrete placed and shall be in units of net tons (2,000 lbs.).

2. There will be no separate measurement for Emulsified Asphalt Prime Coat upon which the surface of concrete pavement section shall be applied.

B. Payment:

1. There will be no separate payment for Emulsified Asphalt Prime Coat or for furnishing all materials; for mixing, hauling and placing the asphalt mixture; for compaction; and for the use of equipment, tools and incidentals, upon which the surface of concrete pavement section shall be applied. Payment shall be included in the unit price for cement treated base course, Section 32 11 33.00.

PART 2 GENERAL

2.1 EQUIPMENT REQUIRED

A. Asphaltic Mixing Plant:

1. One or more asphaltic mixing plants designed to produce a uniform mixture within the job-mix tolerance. Mixing plants may be either the weight-batching type or the continuous mixing type. Both types of plants shall be equipped with
satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins and dust collectors.

B. Asphaltic Concrete Spreading and Finishing Machine:

1. The asphaltic concrete spreading and finishing machine shall be a Barber-Green Model SB-140, or approved equal, equipped with a fully automatic longitudinal and transverse screed control system and shall be equipped with spreader equipment capable of maintaining a near-constant mix level by the use of proportional speed control of feeders and auger. The machine shall be equipped with a Layton, or approved equal, truck hitch. The receiving hopper shall be capable of being power raised and lowered for periodic cleanouts.

C. Asphalt Haul Trucks:

1. A sufficient number of smooth metal-bedded haul trucks, with covers when required, to insure orderly and continuous paving operations.

D. Pressure Distributor:

1. An approved type of self-propelled pressure distributor that is capable of applying the asphaltic tack coat and prime material in the quantity specified, evenly and smoothly without atomization under a pressure necessary for proper distribution.

E. Steel-Wheeled Rollers:

1. One or more self-propelled steel-wheeled rollers. Power rollers shall be of the three-wheel, self-propelled type, weighing not less than 10 tons and shall provide a compression on the rear wheels of not less than 325 pounds per linear inch of tire width. All wheels shall be flat, the rear wheels shall have a diameter of not less than 48 inches, and each shall have a tire width of not less than 20 inches.

2. In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment, as determined by the Port Construction Representative, its use shall be discontinued.

3. Rollers shall be maintained in good repair and operating condition

F. Pneumatic-Tired Rollers:

1. The pneumatic-tire roller shall consist of not less than seven pneumatic-tired wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group, and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such manner that the roller may be turned within a minimum circle. The pneumatic-tire roller under working conditions shall have an effective rolling width of approximately 84 inches and shall be so designed that by ballast loading the total load may be varied uniformly from 23,500 pounds or less to 50,000 pounds or more. The roller shall be equipped with tires that will afford ground contact pressures to 80 pounds per
square inch or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart as directed by the Inspector. The Contractor shall furnish the Inspector with charts and tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the particular tires furnished.

2. The pneumatic-tire roller shall be of the self-propelled type, and the roller, when drawn or propelled by either type of equipment, shall be considered a medium pneumatic-tire roller unit. The power unit shall have adequate tractive effort to properly move the operating roller at variable uniform speeds up to approximately 5 miles per hour.

3. In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Port Construction Representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment as determined by the Port Construction Representative, its use shall be discontinued.

4. Rollers shall be maintained in good repair and operating condition.

G. Power Broom and Blower:
1. One power broom or one power blower or both.

H. Hand Tools:
1. Hand tools necessary to complete the construction in accordance with the Drawings and Specifications herein.

I. Other Equipment:
1. Other equipment may be used in addition to, or in lieu of, the specified equipment when approved by the Port Construction Representative in writing.

2.2 TESTING

A. General:
1. The testing and inspection of materials as required by the Specifications, or as deemed advisable by the Port Construction Representative, unless specified otherwise herein, will be performed by a commercial laboratory employed by and paid directly by the Port Authority.

B. Samples:
1. Sampling of asphalt materials shall be in accordance with the latest revision of "Sampling Asphalt Products for Specifications Compliance", Manual Series No. 18 (MS-18), the Asphalt Institute. Sampling of all mineral aggregates shall be in accordance with the latest revision of American Association of State Highway & Transportation Officials (AASHTO) Designation T2 (American Society for Testing Materials (ASTM) Designation D-72). Sampling of the asphalt mixture, as required by the Inspector, shall be in accordance with the latest revision of AASHTO Designation T168 (ASTM Designation D-979).
C. Methods of Testing:

1. Samples of materials will be tested for the requirements of Item 3, below, by the applicable methods specified in such Item.


b. Mineral aggregates will be tested by one or more of the following methods of test of the AASHTO or the ASTM.

c. The mixture will be tested for asphalt content by "Method of Test for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures", AASHTO Designation T 164 (ASTM Designation D-2172). The mixture will be tested for compliance with aggregate grading requirements by "Method of Test for Mechanical Analysis of Extracted Aggregate", AASHTO Designation T 30.

d. With written permission of the Port Construction Representative, if the mixture is produced in a mixing plant having automatic controls and a printout system and the controls are in proper calibration, asphalt content compliance will be determined from recorded data. Hot bin analysis together with batch weight readout data will be used to determine composition compliance.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Method of Test</th>
<th>AASHTO</th>
<th>ASTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of Material Finer than No. 200 Sieve in Aggregate</td>
<td>T 11</td>
<td>C-117</td>
<td></td>
</tr>
<tr>
<td>Unit Weight of Aggregate</td>
<td>T 19</td>
<td>C-29</td>
<td></td>
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<tr>
<td>Sieve Analysis, Fine and Coarse Aggregates</td>
<td>T 27</td>
<td>C-136</td>
<td></td>
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<tr>
<td>Sieve Analysis of Mineral Filler</td>
<td>T 37</td>
<td>D-546</td>
<td></td>
</tr>
<tr>
<td>Abrasion of Coarse Aggregate, Los Angeles Machine</td>
<td>T 96</td>
<td>C-131</td>
<td></td>
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<tr>
<td>Soundness of Aggregates</td>
<td>T 104</td>
<td>C-88</td>
<td></td>
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<tr>
<td>Plastic Fines in Graded Aggregates and Soils by use of the Sand Equivalent Test</td>
<td>T 176</td>
<td>D-2419</td>
<td></td>
</tr>
</tbody>
</table>

2.3 WEATHER LIMITATIONS

1. Asphalt paving mixture shall be placed only when the specified density can be obtained. Precautions shall be taken at all times to compact the mixture before it cools too much to obtain the required density. The mixture shall not be placed on any wet surface or when weather conditions will otherwise prevent its proper handling or finishing. Asphalt surface course and base course mixtures shall not be placed when the air temperature is below 40°F.
3.1 ASPHALT

1. Performance-Graded Binders:

   a. PG binders must be smooth and homogeneous, show no separation when tested in accordance with Tex-540-C, and meet the following requirements.

   b. Separation testing is not required if:

      • a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer,
      • the binder is blended on site in continuously agitated tanks, or
      • binder acceptance is based on field samples taken from an in-line sampling port at the hot mix plant after the addition of modifiers.

<table>
<thead>
<tr>
<th>Property and Test Method</th>
<th>Performance Grade</th>
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<tbody>
<tr>
<td>PG 64</td>
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<tr>
<td>-16</td>
<td>-22</td>
</tr>
</tbody>
</table>

| Average 7-day max pavement design temperature, °C¹ | <64 |
| Min pavement design temperature, °C¹ | >-16 | >-22 |

**ORIGINAL BINDER**

<table>
<thead>
<tr>
<th>Property and Test Method</th>
<th>Performance Grade</th>
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<tbody>
<tr>
<td>Flash point, T 48, Min, °C</td>
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<tr>
<td>Viscosity, T 316.²³ Max, 3.0 Pa s, test temperature, °C</td>
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</tr>
<tr>
<td>Dynamic shear, T 315.⁴ G*/sin(δ), Min, 1.00 kPa Test temperature @ 10rad/sec., °C</td>
<td>64</td>
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<tr>
<td>Elastic recovery, D 6084, 50°F, %Min</td>
<td>-</td>
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</tbody>
</table>
### ROLLING THIN-FILM OVEN (Tex-541-C)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<tbody>
<tr>
<td>Mass Loss, Tex-541-C, Max, %</td>
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<tr>
<td>Dynamic shear, T 315:</td>
<td>64</td>
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<tr>
<td>$G^*/\sin(\delta)$, Min, 2.20 kPa</td>
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<tr>
<td>Test temperature @ 10 rad/sec., °C</td>
<td></td>
</tr>
</tbody>
</table>

### PRESSURE AGING VESSEL (PAV) RESIDUE (R 28)

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>PAV aging temperature, °C</td>
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</tr>
<tr>
<td>Dynamic shear, T 315:</td>
<td>28</td>
</tr>
<tr>
<td>$G^*/\sin(\delta)$, Mas, 5000 kPa</td>
<td>25</td>
</tr>
<tr>
<td>Test temperature @ 10 rad/sec., °C</td>
<td></td>
</tr>
<tr>
<td>Average 7-day max pavement design temperature, °C&lt;sup&gt;1&lt;/sup&gt;</td>
<td>&lt;64</td>
</tr>
<tr>
<td>Min pavement design temperature, °C&lt;sup&gt;1&lt;/sup&gt;</td>
<td>&gt;-16</td>
</tr>
</tbody>
</table>

### Property and Test Method

<table>
<thead>
<tr>
<th>Property and Test Method</th>
<th>Performance Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG 64</td>
<td></td>
</tr>
<tr>
<td>Creep stiffness, T 313.&lt;sup&gt;5,6&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>$S$, max, 300 MPa,</td>
<td></td>
</tr>
<tr>
<td>$m$-value, min, 0.300</td>
<td></td>
</tr>
<tr>
<td>Test temperature @ 60 sec., °C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-6</td>
</tr>
<tr>
<td></td>
<td>-12</td>
</tr>
</tbody>
</table>
Direct tension, T 314.6
Failure strain, min, 1.0%
Test temperature @ 1.0 mm/min., °C

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct tension</td>
<td>-6</td>
<td>-12</td>
</tr>
</tbody>
</table>

1Pavement temperatures are estimated from air temperatures using an algorithm contained in a TxDOT-supplied computer program, may be provided by following the procedures outlined in AASHTO MP 2 and PP 28.

2This requirement may be waived at the Port Construction Representative’s discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed, and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).

3Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.

4For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of G*/sin(δ) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).

5Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.

6If creep stiffness is below 300 MPa, direct tension test is not required. If creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

3.2 PRIME COAT:

A. Emulsified Asphalt. Emulsified asphalt must be homogeneous, does not separate after thorough mixing, and must meet the requirements for the specified type and grade.

### Emulsified Asphalt

<table>
<thead>
<tr>
<th>Type-Grade</th>
<th>Medium Setting</th>
<th>Slow Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test Procedure</td>
<td>Min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol</td>
<td>T 72</td>
<td></td>
</tr>
<tr>
<td>77°F, sec.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>122°F, sec.</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>Test Description</td>
<td>Method</td>
<td>Value 1</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>T 59</td>
<td>-</td>
</tr>
<tr>
<td>Miscibility</td>
<td>T 59</td>
<td>-</td>
</tr>
<tr>
<td>Cement Mixing, %</td>
<td>T 59</td>
<td>-</td>
</tr>
<tr>
<td>Coating Ability and Water Resistance:</td>
<td>T 59</td>
<td>-</td>
</tr>
<tr>
<td>dry aggregate/after spray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>wet aggregate/after spray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demulsibility, 35 ml of 0.02 N CaCl₂, %</td>
<td>T 59</td>
<td>-</td>
</tr>
<tr>
<td>Storage Stability, 1 day, %</td>
<td>T 59</td>
<td>-</td>
</tr>
<tr>
<td>Freezing Test, 3 cycles¹</td>
<td>T 59</td>
<td>Pass</td>
</tr>
<tr>
<td>Distillation Test:</td>
<td>T 59</td>
<td></td>
</tr>
<tr>
<td>Residue by Distillation, % by wt.</td>
<td></td>
<td>65</td>
</tr>
<tr>
<td>Oil Distillate, % by volume of emulsion</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Tests on Residue from Distillation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration, 77°F, 100g, 5 sec.</td>
<td>T 49</td>
<td>120</td>
</tr>
<tr>
<td>Solubility in Trichloroethylene, %</td>
<td>T 44</td>
<td>97.5</td>
</tr>
<tr>
<td>Ductility, 77°F, 5 cm/min., cm</td>
<td>T 51</td>
<td>100</td>
</tr>
<tr>
<td>Float test, 140°F, sec.</td>
<td>T 50</td>
<td>-</td>
</tr>
</tbody>
</table>

¹Supply with each shipment of PCE:

a) a copy of a lab report from an approved analytical lab, signed by a lab official, indicating the PCE formulation does not meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste;
b) a certification from the producer that the formulation supplied does not differ from the one tested and that no one listed RCRA hazardous wastes or PCB’s have been mixed with the product; and
c) a Material Safety Data Sheet.

B. Specialty Emulsions. Specialty emulsion may be either may be either asphalt-based or resin-based and must meet the following requirements.
### Specialty Emulsions

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Procedure</th>
<th>Slow Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PCE¹</td>
<td>Min</td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol</td>
<td>T 72</td>
<td></td>
</tr>
<tr>
<td>77°F, sec.</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>122°F, sec.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>T 59</td>
<td></td>
</tr>
<tr>
<td>Miscibility²</td>
<td>T 59</td>
<td>pass</td>
</tr>
<tr>
<td>Demulsibility, 35 ml of 0.10 N CaCl₂,%</td>
<td>T 59</td>
<td></td>
</tr>
<tr>
<td>Storage Stability, 1 day, %</td>
<td>T 59</td>
<td></td>
</tr>
<tr>
<td>Particle Size, % by volume&lt;2.5 um</td>
<td>Tex-238-F³</td>
<td></td>
</tr>
<tr>
<td>Residue after both Distillations, % by wt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Oil Distillate from both distillations, % by volume of emulsion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distillation:</td>
<td>T 59</td>
<td></td>
</tr>
<tr>
<td>Residue by Distillation, % by wt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporation:⁴</td>
<td>T 59</td>
<td></td>
</tr>
<tr>
<td>Residue by Evaporation, % by wt.</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Tests on Residue from Distillation(s):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity, 140°F, poise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinematic Viscosity, 140°F, cSt</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Flash Point, C.O.C., °F</td>
<td>T 48</td>
<td>400</td>
</tr>
<tr>
<td>Solubility in Trichloroethylene, %</td>
<td>T 44</td>
<td></td>
</tr>
</tbody>
</table>

Asphalt Emulsion Distillation to 500°F followed by Cutback

Asphalt Distillation of Residue to 680°F:

- Residue after both Distillations, % by wt.
- Total Oil Distillate from both distillations, % by volume of emulsion

Distillation:

- Residue by Distillation, % by wt.

Evaporation:

- Residue by Evaporation, % by wt.

Tests on Residue from Distillation(s):
3.3 **TACK COAT**

A. Tack coat shall be either CSS-1 or CSS-1H and shall meet the following requirements:

**Cationic Emulsified Asphalt**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Procedure</th>
<th>Type-Grade</th>
<th>Slow Setting</th>
<th>Slow Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>CSS-1</strong></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Viscosity, Saybolt Furol</td>
<td>T 72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>77°F, sec.</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>122°F, sec.</td>
<td></td>
<td></td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Sieve Test</td>
<td>T 59</td>
<td></td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>Cement Mixing, %</td>
<td>T 59</td>
<td></td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>Coating Ability and Water Resistance:</td>
<td>T 59</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dry aggregate/after spray</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wet aggregate/after spray</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demulsibility, 35 ml of 0.8% sodium dioctyl</td>
<td>T 59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sulfosuccinate, %</td>
<td>T 59</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Storage Stability, 1 day, %</td>
<td>T 59</td>
<td></td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Particle Charge</td>
<td>T 59</td>
<td></td>
<td>positive</td>
<td>positive</td>
</tr>
<tr>
<td>Distillation Test:</td>
<td>T 59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residue by Distillation, % by wt.</td>
<td></td>
<td></td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Oil Distillate, % by volume of emulsion</td>
<td></td>
<td></td>
<td>-</td>
<td>0.5</td>
</tr>
<tr>
<td>Tests on Residue from Distillation(s):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration, 77°F, 100 g, 5 sec.</td>
<td>T 49</td>
<td></td>
<td>120</td>
<td>160</td>
</tr>
<tr>
<td>Solubility in Trichloroethene, %</td>
<td>T 44</td>
<td></td>
<td>97.5</td>
<td>-</td>
</tr>
<tr>
<td>Ductility, 77°F, 5 cm/min., cm</td>
<td>T 51</td>
<td></td>
<td>100</td>
<td>-</td>
</tr>
</tbody>
</table>

3.4 **MINERAL AGGREGATE**
A. Base Course:

1. The mineral aggregate for the base course mixture shall be crushed stone, crushed or uncrushed gravel, slag, sand, stone or slag screenings, mineral dust or a combination of two or more of these materials. The combined aggregate after going through the dryer shall have a sand equivalent value of not less than 40.

2. Slag, if used, shall be air-cooled blast-furnace slag and shall weigh not less than 70 pounds per cubic foot.


B. Surface Course:

1. The mineral aggregate for the surface course mixture shall be crushed stone, crushed gravel, crushed slag, sharp-edged natural sand, or a combination of two or more of these materials. The combined aggregate after going through the dryer shall have a sand equivalent value of not less than 50. Course aggregate (material retained on the U.S. Standard No. 8 sieve) shall have a percent wear by the Los Angeles abrasion machine test of not more than 40.

2. Fine aggregate (material passing the U.S. Standard No. 8 sieve) shall have a maximum loss of 12 percent at 5 cycles in a sodium sulfate solution by the Soundness of Aggregates test or shall have been proved sound through satisfactory service.

3. Slag, if used, shall be air-cooled blast-furnace slag and shall weigh not less than 70 pounds per cubic foot.

4. Fifty percent (50%) by weight of the combined coarse aggregate, other than naturally occurring rough-textured aggregate, approved by the Port Construction Representative, shall consist of crushed pieces having one or more faces produced by fracture.


3.5 ASPHALT – AGGREGATE MIXTURE

A. Base Bond Breaker Course:

1. The job-mix formula for each mixture shall be specified by the Port Construction Representative. The job-mix formula for the asphalt aggregate base course mixture shall be within the following limits:

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>Total Percent Passing, by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 in</td>
<td>100</td>
</tr>
<tr>
<td>3/8 in</td>
<td>85-100</td>
</tr>
<tr>
<td>No. 4</td>
<td>50-70</td>
</tr>
</tbody>
</table>
Asphalt Cement Content 3.5 to 7.0 *percent by weight of total mix

*Upper limit may be raised when using absorbent aggregate. The asphalt-aggregate base course

2. Mixture shall meet the following test criteria:

Number of compacting blows, each end of specimen (Marshall Method) 50
Stability (Marshall Method) 1500 Min.
Flow (Marshall Method) 8 Min. 14 Max.
Voids Total Mix (Marshall Method), % 3 Min. 8 Max.
Aggregate Voids filled with Asphalt, % 75 Min. 85 Max.
Voids in Mineral Aggregate, % 13.5 Min. -

Job-Mix Test Tolerances for Base and Surface Course:

The following tolerances for the job-mix formula will be allowed per single test:

<table>
<thead>
<tr>
<th>PASSING SIEVE</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4 and larger</td>
<td>±7</td>
</tr>
<tr>
<td>No. 8 through No. 100</td>
<td>±4</td>
</tr>
<tr>
<td>No. 200</td>
<td>±2</td>
</tr>
<tr>
<td>Asphalt</td>
<td>±0.4</td>
</tr>
</tbody>
</table>
PART 4  CONSTRUCTION

4.1 SUBGRADE PREPARATION

A. General:

1. The area to be paved shall be true to line and grade. It shall have a dry, firm, and properly prepared surface before paving operations begin. All loose and foreign material shall be removed.

B. Prime Coat for Loosely Bonded Subgrade or Base:

1. When the compacted subgrade or base on which the asphalt base is to be placed is loosely bonded, as designated by the Port Construction Representative, it shall be primed with 0.35 to 0.5 gallon per square yard of the type and grade of asphalt priming material designated in Item 3.A.(2) above. The prime shall be applied in accordance with Specification P-1, "Asphalt Priming of Granular Type Base Course", The Asphalt Institute.

C. Prime Coat for Tightly Bonded Base:

1. The prepared aggregate shall be primed as designated by the Port Construction Representative with 0.35 to 0.5 gallon per square yard of the type and grade of asphalt priming material designated in Item 3.A.(2) above. The prime shall be applied in accordance with Specification P-1, "Asphalt Priming of Granular Type Base Courses", The Asphalt Institute.

D. Patching or Overlaying Existing Paved Surfaces:

1. Holes and depressions in existing surfaces shall be prepared by removing all loose and defective material to sound pavement and replacing with an asphalt-aggregate patching material. The patching mixture shall be compacted to produce a tight surface conforming to the adjacent pavement area.

2. Rocking Portland cement concrete slabs shall be stabilized by undersealing or shall be broken and seated firmly on the subgrade or sub-base. When the pavement has been rendered uniformly stable, it shall be cleaned, tacked properly with asphalt, and covered with a leveling course of the asphalt mixture to be used for the overlay.

3. Excess asphalt in patches and joints shall be removed by burning or other method approved by the Inspector.

4. A leveling course of asphalt concrete shall be placed on the existing surface.

5. Immediately prior to application of the asphalt tack coat, all loose and foreign material shall be removed.

6. Surfaces of curbs, gutters, vertical faces of existing pavements, and all structures to be in actual contact with the asphalt-aggregate mixture shall be given a thin even coating of RC-250 asphaltic material. Care shall be taken to prevent spattering with asphalt, surfaces that will not be in contact with the asphalt-aggregate mixture.
4.2 TACK COAT:

A. A tack coat of 0.05 to 0.15 gallon per square yard (rate of application to be designated by the Port Construction Representative) of the type and grade designated in Item 3.A.(3), above, shall be applied to each layer of base course and allowed to cure before placing the succeeding course. Emulsified asphalt shall be diluted with equal parts of water. The tack coat shall be applied on only as much pavement as can be covered with asphalt-aggregate mixture in the same day or as directed by the Inspector.

4.3 MIXTURE PREPARATION:

A. The asphalt shall be heated at the paving plant to a temperature at which it can be applied uniformly to the aggregate. The asphaltic material storage shall be ample to meet the requirements of the plant. Asphaltic materials shall not be heated in excess of 400°F.

B. Coarse and fine aggregates shall be stored separately at the paving plant in a manner that will prevent intermingling. Stockpiles shall be built in a manner that will prevent segregation of aggregate sizes. If the aggregate tends to segregate during handling, it shall be supplied and stockpiled in two or more sizes.

C. When it is necessary to blend aggregates from one or more sources to produce the combined gradation, each source or size of aggregate shall be stockpiled individually. Aggregate from the individual stockpiles shall be fed through separate bins to the cold elevator feeders. They shall not be blended in the stockpile.

D. Cold aggregates shall be fed carefully to the plant so that surpluses and shortages will not occur and cause breaks in the continuous operation.

E. The aggregate shall be dried and heated to provide an asphaltic paving mixture temperature immediately after mixing of 225 to 350°F + 15°F. At no time shall the mixing temperature exceed 350°F.
The following is a tabulation of minimum asphalt placement temperatures:

<table>
<thead>
<tr>
<th>Temperature of base on which mix is placed, °F</th>
<th>Thickness of layers being placed, inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>3/4</td>
</tr>
<tr>
<td>+20</td>
<td></td>
</tr>
<tr>
<td>+32</td>
<td></td>
</tr>
<tr>
<td>+40</td>
<td></td>
</tr>
<tr>
<td>+50</td>
<td></td>
</tr>
<tr>
<td>+60</td>
<td></td>
</tr>
<tr>
<td>+70</td>
<td></td>
</tr>
<tr>
<td>+80</td>
<td></td>
</tr>
<tr>
<td>+90</td>
<td>280</td>
</tr>
</tbody>
</table>

*Increase by 15° when placement is on base or sub-base containing frozen moisture.

F. Mix delivered to the jobsite that is hotter than 350°F, or at a temperature determined by the Inspector, to be too hot for proper compaction without distortion shall not be dumped and spread until it has cooled sufficiently to allow such proper compaction. Mix that is colder than the minimum temperatures tabulated above will be rejected.

G. The moisture content of the heated and dried aggregate shall not exceed 0.05 to 2.0 percent as directed by the Inspector.

H. Heated and dried aggregates shall be screened and stored in sizes that may easily be recombined into a gradation meeting the requirements of the job-mix formula except on large volume jobs, for base mixtures, the screens may be removed from the plant and a single bin may be used if careful control of the cold aggregate feed is maintained and all job-mix formula requirements are met.
I. For batch plants, the Port Construction Representative will designate whether or not a dry mixing cycle will be required. The Port Construction Representative will designate the length of mixing times within the following limits:

- Maximum dry = 15 seconds
- Minimum wet = 20 seconds
- Maximum wet = 60 seconds

J. Mixing times will be established by the Port Construction Representative based on the Ross Count Procedure. The mixing times will be set to achieve the following percent of coated particles:

<table>
<thead>
<tr>
<th>Type of Aggregate</th>
<th>Surface</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense, such as trap rock, limestone, gravel</td>
<td>95%</td>
<td>90%</td>
</tr>
<tr>
<td>Cellular (honeycombed), such as slag, coral, limework</td>
<td>90%</td>
<td>85%</td>
</tr>
</tbody>
</table>

K. For continuous mix plants, the Port Construction Representative will designate the mixing time within the following limits:

- Minimum = 20 seconds
- Maximum = 70 seconds

L. The mixing time will be computed by the following formula:

\[
\text{Mixing time, seconds} = \frac{\text{Pugmill Dead Capacity, lb.}}{\text{Pugmill Output, lb. per sec.}}
\]

4.4 PLACING THE MIX

A. The base course mixture shall be placed in one or more lifts not greater than 3-inches thick to provide the compacted thickness designated on the Drawings. The surface course mixture shall be placed with an asphalt paver to provide the compacted thickness designated on the Drawings. The minimum lift thickness shall be at least two times the maximum particle size. Placing the mixture shall be a continuous operation. If any irregularities occur, they shall be corrected before final compaction of the mixture.

4.5 COMPACTING THE MIXTURE

A. The mix shall be compacted immediately after placing. Initial rolling with a steel-wheeled tandem roller, steel three wheeled roller, vibratory roller, or a pneumatic-tired roller shall follow the paver as closely as possible. Intermediate rolling with a pneumatic-tired roller shall be done immediately behind the initial rolling. Final rolling shall eliminate marks from previous rolling. In areas too small for the roller, a vibrating plate compactor or a hand tamper shall be used to achieve thorough compaction.
4.6 PAVEMENT THICKNESS, DENSITY, AND SURFACE REQUIREMENTS

A. Density:

1. The compacted base and surface shall each have a density equal to or greater than 95 to 97 percent of a laboratory specimen prepared by the method for asphalt-aggregate mixture specified in Item 3.C. above, as determined from a sample taken from a truck delivering mixture to the jobsite. The laboratory density will be compared with the field density at the location of the same truckload of mixture from which the laboratory specimen was made.

B. Thickness:

1. The compacted base and surface shall have a minimum total thickness no less than that specified on the Drawings. Any deficiency in base thickness shall be made up with surface mixture when the surface course is placed.

C. Cores for Testing Thickness and Density:

1. Cores drilled or specimens sawed from the base course and surface course will be used to measure the thickness of the pavement. The same cores will be used to test the density by either ASTM Method of Test D-1188, "Bulk Specific Gravity of Compacted Bituminous Mixtures, Using Paraffin-Coated Specimens", or ASTM Method of Test D-2726, "Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface Dry Specimens", whichever is applicable.

D. Surface Test:

1. The surface of the pavement, after compaction, shall be smooth and true to the established line, grade and cross-section and, (a) when tested with a 10-foot straight-edge (or other equivalent and acceptable means) placed in any direction on flat surfaces, the maximum deviation shall not exceed 1/8 inch above or below the true theoretical plane in 10 feet, (b) when tested with a string line (or other equivalent and acceptable means) placed in any direction on flat surfaces, the maximum deviation shall not exceed 1/2 inch above or below the true theoretical plane in 50 feet, and (c) when tested with a 10-foot template (or other equivalent and acceptable means) provided by the Contractor to fit a required curved surface, the maximum deviation shall not exceed 3/16 inch above or below such required surface in 10 feet. Any surface areas not meeting these requirements shall be corrected in a manner acceptable to the Port Construction Representative.

E. Density by Nuclear Device:

1. The density of the base and surface courses may be checked by the use of a nuclear device in lieu of the method in Item F.(1) and F.(3), above. The compacted base and surface shall have a density equal to or greater than 95 to 97 percent of a laboratory specimen prepared by the method for asphalt-aggregate mixture specified in Item 3, above.
F. Thickness by Nuclear Device:

1. The thickness of base and surface coarse may be determined by the use of a nuclear device in lieu of the method in Item F.(3) above. The thickness may be computed by use of the following equation:

\[ t = \frac{W/O}{0.75d} \]

where

- \( t \) = pavement thickness, inches
- \( w \) = average weight per square yard of base and surface mixture actually used in work
- \( d \) = compacted density of base or surface course as measured by the nuclear density device

END OF SECTION
PART 1    GENERAL

1.1 SECTION INCLUDES

   A. Subject to the General and Special Conditions, this Section includes the furnishing of all labor, material, tools, equipment, and the performance of all operations required to complete all concrete work indicated on the Drawings and herein specified. These Specifications apply to normal weight concrete only. Included are retaining walls, grade beams and pilasters.

1.2 SUBMITTALS

   A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

   B. Contractor shall submit Mill Certificates for bulk cement.

   C. Design Mixes:

      1. Submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, maximum coarse aggregate size, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ratio; compressive strength test results for 7 and 28 days; and shrinkage tests for Class C and D concrete at 21 or 28 days of drying.

      2. Submit abrasion loss and soundness test results for limestone aggregate.

      3. Testing of aggregates, including sieve analysis, shall be performed by a certified independent testing laboratory. Tests shall have been performed no earlier than 3 months before Notice to Proceed.

      4. Provide standard deviation data for plant producing concrete. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 318, Item 5.3.1. Laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 318, Table 5.3.2.2.

      5. Review and acceptance of mix design does not relieve Contractor of responsibility to provide concrete of quality and strength required by these Specifications.
D. Admixtures: Acceptable brands of admixture are listed herein. If proposed products are
difference from those listed, submit manufacturer's technical information, including the
following information, for review. Submit manufacturer's technical information, including
following:

1. Air-Entraining Admixture: Give requirements to control air content under all
conditions, including temperature variations and presence of other admixtures.

2. Chemical Admixtures: Give requirements for quantities and types to be used
under various temperatures and job conditions to produce uniform, workable
concrete mix. Submit evidence of compatibility with other admixtures and
cementitious materials proposed for use in design mix.

3. Submit evidence that the admixture proposed for use with cement containing fly
ash are compatible with the fly ash.

4. Submit evidence that admixture proposed for use along with a superplasticizer
are compatible with the proposed superplasticizer.

E. High-range Water Reducer (Superplasticizer): When proposed for use, submit
manufacturer's technical information and instructions for use of superplasticizer. State
whether superplasticizer will be added at ready-mix plant or job site. When
superplasticizer will be added at job site, submit proposed plan for measuring and adding
superplasticizer to concrete mix at job site, and establish dosing area on site with holding
tanks and metering devices. When superplasticizer is to be added at ready-mix plant,
submit contingency plans for adding additional superplasticizer at job site when required
due to delay in placing concrete. Identify portions of Work on which superplasticizer is
proposed for use.

F. Limestone Aggregate: Submit test data confirming that the limestone aggregate
proposed for use on the project conforms to these specifications.

G. Curing Method: Submit the proposed curing method for all concrete. Use of a
membrane-forming curing compound is not permitted.

H. Curing and Sealing Compound: Submit manufacturer's technical information for proposed
curing and sealing compound. Submittal shall include the specified testing laboratory test
data.

I. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and
cold weather concreting. Review and acceptance of proposed procedure will not relieve
Contractor of responsibility for quality of finished product.

J. Project Record Drawings: Accurately record actual locations of embedded utilities and
components which are concealed from view.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment will be made for concrete construction under
this Section. Include payment in unit price of items for which concrete construction is a
component.

1.4 REFERENCES
A. All concrete construction shall be in accordance with the latest edition of the ACI Manual of Concrete Practice, Parts 1 thru 3, unless specifically noted otherwise in these Specifications and the other Contract Documents.

1.5 PRECONSTRUCTION CONFERENCE

A. Before the preparation of shop drawings for formwork or reinforcing steel, or the start of any concrete construction on the site schedule a concrete preconstruction conference to discuss both structural and architectural concrete. Attendees to include the Port Authority, Engineer, General Contractor, ready-mix concrete supplier, form supplier, reinforcing steel supplier and detailer, forming subcontractor, pumping subcontractor or others who will have a major part in the production of the concrete elements.

B. At least 2 weeks before the pre construction conference, provide submittals required in this and allied sections, of all information available at the time.

C. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the Port Authority, the testing laboratory, and the Engineer for information purposes. This minutes shall include a statement by the admixture manufacturer(s) indicating that the proposed mix design and placing techniques can produce the concrete quality required by these specifications.

1.6 STORAGE OF MATERIALS

A. Cement shall be stored in weather tight buildings, bins, or silos which will exclude moisture and contaminants and to minimize warehouse set. If there are any questions as to the expansive potential of shrinkage-compensating cements because of method or length of storage and exposure, the cement shall be laboratory tested before use.

B. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layer not exceeding 3 feet in thickness. Complete each layer before the next is started. Do not stockpile coarse aggregate in a cone. To ensure that this condition is met, any test for determining conformance to requirements for cleanliness and grading shall be performed on samples secured from the aggregates at the point of batching. Frozen or partially frozen aggregates shall not be used.

C. Fine Aggregate shall be allowed to drain until a uniform moisture content is reached before it is used.

D. Admixtures shall be stored in such a manner as to avoid contamination, evaporation, or damage. For those used in the form of suspensions or non-stable solutions, agitating equipment shall be provided to assure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

1.7 CODE REQUIREMENTS

A. All concrete construction shall conform to the Building Code Requirements for Reinforced Concrete, ACI 318. Where the project specifications conflict with ACI 318, the project specifications shall control.
1.8 ENVIRONMENTAL REQUIREMENTS

A. Contractor shall comply with standards for air quality or air emissions associated with concrete production during construction.

1.9 TESTING

A. The concrete testing required in this section, except for the concrete mix design, the limestone aggregate test data, and testing of deficient concrete, will be performed by a commercial testing laboratory employed and paid by the Port Authority as specified in the General Conditions and Section 01455, Testing Laboratory Services.

B. Provide material cooperate fully with Port Authority’s testing laboratory technician in obtaining samples for required tests.

1.10 QUALITY ASSURANCE

A. Provide the necessary controls during evaluation of materials, mix designs, production, and delivery of concrete, placements, compaction, finishing, and curing necessary to assure that the work will be accomplished in accordance with the contract documents.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: Portland cement shall conform to the requirements of "Standard Specification for Portland Cement," ASTM Designation C150, for either Type I cement or Type II. Type III shall be used only when approved by the Port Construction Representative in writing. Type III cement will not be permitted in structures constructed in or above the water or in portions of structures below ground. Use the same brand of cement used in the concrete mix design. Only one brand of each type will be permitted in any one structure unless otherwise specified.

B. Aggregate: Fine and coarse aggregate shall comply with the requirements of Specifications for Concrete Aggregate, ASTM Designation C33. Use coarse aggregate from only one source and fine aggregate from only one source for exposed concrete in a single structure.

1. Coarse aggregate for concrete of normal weight shall consist of gravel, crushed gravel or crushed limestone conforming to ASTM C 33.

2. Fine aggregate shall be natural sand complying with ASTM C 33.

3. Limestone aggregate shall conform to the requirements of ASTM C 33 with the following additional requirements: Limestone aggregate shall consist of clean, hard, strong, and durable particles free of chemicals, coatings of silt or clay, or other fine materials that may affect hydration and bond of the cement paste. The select crushed limestone shall be high-calcium limestone (minimum 95 percent CaCO₃ and maximum 3.5 percent MgCO₃) with maximum Los Angeles Abrasion loss of 38 percent; when tested in accordance with ASTM C 131 or ASTM C 535. The aggregate shall be tested for soundness in accordance with ASTM C 88. The maximum loss shall not exceed 18 percent after 5 cycles or the magnesium sulfate test.
4. The maximum size of coarse aggregate shall be as follows:
   a. Normal weight concrete, except as noted below – 1 ½ inches (ASTM C 33, size No 467).
   b. Formed members 6 inches or less in least dimension – ¾ inch maximum (ASTM C 33, size No. 67).
   c. Slabs 6 inches or less in depth – ¾ inch maximum (ASTM C 33, size No. 67).

C. Water: Mixing water for concrete shall be fresh, clean and potable. The Contractor is responsible for supplying water for construction in accordance with Section 01 50 00.00 - Temporary Facilities and Controls.

D. Admixtures: Use the following admixture as required. The use of calcium chloride, thicyanates or admixtures containing more than 0.05 percent chloride ions are not permitted.
   1. Air Entrainment: An approved brand of air entraining agent conforming to "Specifications for Air-Entraining Admixtures for Concrete", ASTM C260 shall be used with all concrete. It shall be introduced in the mixture at the mixer in such quantities as to provide not more than five percent nor less than three percent entrained air as determined by tests performed in accordance with ASTM C138. Entrained air in concrete floor slabs shall not exceed 4.5 percent. Acceptable products are Master Builder’s “MB-VR,” Sika’s “AER,” Euclid Chemical Company’s “Air-Mix,” W.R. Grace’s “Daravair” or approved substitution.
   2. Water-Reducing, Retarding and Accelerating Admixtures (Superplasticizer):
      a. Water-reducing, retarding and accelerating admixtures shall conform to the requirements of "Specifications for Chemical Admixtures for Concrete,” ASTM C 494. Acceptable manufacturers are:
         1) W. R. Grace and Co.
         2) BASF
         3) Sika Chemical Co.
         4) Fox Industries, Inc.
      b. Products of other manufacturers may be submitted for approval. No admixture containing calcium chloride as a functional ingredient may be used at any time.
      c. The manufacturer shall submit a statement of conformance to ASTM C494, including test results. In addition, the manufacturer shall state, in writing, the chloride content of the admixture and whether or not chloride has been added during its manufacture.
   3. Clear Curing and Sealing Compound (VOC Compliance): Comply with ASTM C 1315-95, Type I, Class A, clear, non-yellowing.
   5. Nonshrink Grout: Grout shall conform to the requirements of Section 03605, Nonshrink Grout.
7. Fly Ash:
   a. Fly ash shall conform to the requirements of ASTM C 618.
   b. Fly ash shall be produced from coal from a single known and consistent source.

8. Vapor Retarder: Where shown or noted. Over prepared base material provide membrane complying with ASTM E 1745, Class A. Joints and penetrations shall be sealed with manufacturer's standard tape intended for such use.

2.2 FORM MATERIALS

A. Form materials shall be of wood, metal, fiberglass, or other material approved by the Port Construction Representative. Wherever rubbed surfaces are indicated on the Drawings or hereinafter specified, the forms shall be lined, plywood, or approved metal forms. Forms shall conform to the following requirements:

1. Unlined Wood Forms: Lumber used in forms or exposed surfaces shall be dressed to a uniform thickness, and shall be free from loose knots, splits, or other defects. Undressed lumber may be used for unexposed surfaces. Joints in forms shall be horizontal or vertical.
2. Lined Forms: Lining material shall be moisture resistant concrete-form plywood, form grade hardboard, metal, plastic, or other approved material.
3. Universal Standard Plywood Form Panels: Panels shall be designed to produce and maintain shape, lines and dimensions of the concrete as called for on the Drawings.
4. Metal Forms: Metal forms shall be an approved type that will produce surfaces equal to those produced by specified wood forms. Headers, bridging, appurtenances, or special metal forms in accordance with requirements peculiar to the design of the forms shall be provided and installed where required.
5. Plywood Forms: Plywood shall be moisture resistant concrete-form plywood at least 9/16-inch in thickness, and not less than 5-ply.

2.3 CLASSIFICATION

A. The Drawings and/or the Technical Specifications for each item of work indicate the class of concrete to be used for each element of the work. Each class of concrete shall meet the requirements tabulated below:

<table>
<thead>
<tr>
<th>Class</th>
<th>Minimum Compressive Strength</th>
<th>Graduation of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>at 28 Days</td>
<td>at 7 Days</td>
</tr>
<tr>
<td>A</td>
<td>3000</td>
<td>2000</td>
</tr>
<tr>
<td>B</td>
<td>3000</td>
<td>2000</td>
</tr>
<tr>
<td>C</td>
<td>3000</td>
<td>2000</td>
</tr>
<tr>
<td>D</td>
<td>4000</td>
<td>3000</td>
</tr>
<tr>
<td>E</td>
<td>4000</td>
<td>3000</td>
</tr>
<tr>
<td>F</td>
<td>4000</td>
<td>3000</td>
</tr>
<tr>
<td>G</td>
<td>5000</td>
<td>4000</td>
</tr>
</tbody>
</table>
### 2.4 PROPORTIONING OF CONCRETE

**A. Objective:** The concrete shall be composed of Portland cement, coarse aggregate, fine aggregate, approved admixtures and water. Concrete shall meet all requirements herein for strength, cement content, water-cement ratio, slump, etc. Concrete shall have adequate workability and proper consistency to be worked readily into the forms and around reinforcement under the conditions of placement to be employed without excessive segregation or bleeding. Minimum cement content shall conform to these specifications. Proportion ingredients to produce a homogeneous moisture which will work readily into corners and angles of forms and around reinforcement by methods of placing and consolidation employed on the project, but without permitting materials to segregate or allowing excess free water to collect on the surface.

**B. Mix Design:** The Contractor shall employ, at his expense, a commercial testing laboratory acceptable to the Port Authority, to prepare and test mix designs for each type of concrete specified herein. The mix design ingredients shall be proportioned by weight. The mix design and test results shall be submitted for review. Where mix design is based on prior performance record, the laboratory will verify the experience required by ACI 318 and that those materials and proportions to be furnished are the same as those on which experience records are based.

**C. Strength:** Strength must conform to values for the class of concrete specified for each portion of the project. Requirements are based on a 28-day compressive strength. If high early strength concrete is allowed, requirements are based on 7-day compressive strength.

**D. Selecting Ingredient Proportions for Concrete:** Proportions shall be established by the Contractor and submitted to the Port Construction Representative for verification by a testing laboratory selected by the Port Construction Representative. Mix design shall be based on the procedures of ACI 318, "Building Code Requirements for Reinforced Concrete;" However, the minimum cement content for each class of concrete shall not be less than specified herein. Proportions may be established on the basis of field experience with the materials to be employed or on the basis of laboratory trial batches. The concrete mix design submitted for review must have an average 28-day compressive strength calculated in accordance with ACI 318, item 5.3.2.1. When data is not available to determine the standard deviation in accordance with ACI 318, item 5.3.1, the average 28-day strength of the mix design shall conform to ACI 318, Table 5.3.2.2.

**E. Fly Ash:** Fly ash may be substituted for part of the cement. If fly ash is used in the proposed concrete mix, the percent of fly ash by weight in the combined fly ash cement mixture shall not exceed 27 percent. Additionally, fly ash must be from a single source.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>5000</td>
<td>4000</td>
<td>1” to No. 4</td>
</tr>
<tr>
<td>I</td>
<td>5000</td>
<td>4000</td>
<td>3/4” to No. 4</td>
</tr>
<tr>
<td>J</td>
<td>2500</td>
<td>1670</td>
<td>1-1/2” to No. 4</td>
</tr>
<tr>
<td>K</td>
<td>2500</td>
<td>1670</td>
<td>3/4” to No. 4</td>
</tr>
</tbody>
</table>
F. Where mix design is based on trial batches, the Contractor, at least ten days prior to placing concrete, shall submit a mix design and samples of all concrete materials to the Port Construction Representative. The laboratory will make up at least two batches of each class of concrete using the proportions of materials as submitted. A minimum of four standard size cylinders from each batch shall be molded, properly cured, and tested for seven-day compressive strengths as outlined in the latest ASTM test standards. If these cylinders fail to meet the required breaking strength, the mix shall be redesigned and more batches and specimens made and tested as above. This procedure shall be repeated until a satisfactory batch design has been determined. After the mix proportions and water-cement ratio required to produce the given strength have been determined, the Contractor may begin placing the concrete. The mix shall be redesigned during the job as may be necessary to obtain the specified strength, or if a change in materials is desired, in the same manner as outlined for the initial design.

G. Water-Cement Ratio: Cement content shall be based on the following water cement ratios, except that minimum cement content shall be five (5) sacks per cubic yard:

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>Max. Water-Cement Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structures constructed in, above or immediately adjacent to the water; other structures exposed to the action of water</td>
<td>0.44</td>
</tr>
<tr>
<td>Thin sections in air or not exposed to water such as pipe piles, ledges, railing and curbs; pavement</td>
<td>0.53</td>
</tr>
<tr>
<td>Moderate sections, such as retaining walls, abutments, piers, girders and beams; concrete protected from weather or below ground</td>
<td>Determined by strength requirements</td>
</tr>
</tbody>
</table>

H. Water Reducer (Super plasticizer): Super plasticizer may be added as specified to obtain maximum water-cement ratios. Include free water in the aggregate in all water-cement ratio computations. When fly ash is substituted for part of the cement, the weight of the cement plus fly ash shall be used in calculating the water-cement ratio. The super plasticizer must be used in strict accordance with the requirements and recommendations of the product manufacturer. The super plasticizer shall not be added to the concrete mix until after verification of the initial slump by the testing laboratory. The concrete shall be super plasticizer in conformance with the Contractor’s plans submitted for review.

I. Adjustment of Mix Proportions: After sufficient data becomes available during construction the mix may be adjusted upon approval of the Engineer, in accordance with ACI 318, item 5.5, “Average Strength Reduction”; however, the minimum cement contact for each class of concrete shall not be less than specified herein.
J. **Entrained Air:** Air-entrain all concrete unless otherwise specified. Air content as determined in accordance with ASTM C 173 shall be as follows:

<table>
<thead>
<tr>
<th>Concrete Type</th>
<th>Maximum Aggregate Size in Inches</th>
<th>Total Air Content Range % by Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Weight</td>
<td>3/8</td>
<td>6-10</td>
</tr>
<tr>
<td>&quot;</td>
<td>1/2</td>
<td>5-9</td>
</tr>
<tr>
<td>&quot;</td>
<td>3/4</td>
<td>4.5-7.5</td>
</tr>
<tr>
<td>&quot;</td>
<td>1</td>
<td>4.5-7.5</td>
</tr>
<tr>
<td>&quot;</td>
<td>1 1/2</td>
<td>4-6</td>
</tr>
<tr>
<td>&quot;</td>
<td>2</td>
<td>2.5-5.5</td>
</tr>
<tr>
<td>&quot;</td>
<td>3</td>
<td>1.5-4.5</td>
</tr>
</tbody>
</table>

K. **Slump:** Unless indicated otherwise on the Drawings, Technical Specifications or other Specifications, the maximum slump shall be four inches (4”); the minimum is three (3”) inches. Determine slump by methods given in ASTM C 143. The specified slump shall apply at the time when the concrete is discharged at the jobsite. Higher slumps may be approved by the Port Construction Representative if achieved without detrimental effects to the concrete.

L. **Maximum Size of Coarse Aggregate:** The nominal maximum size of the aggregate shall not be more than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between reinforcing bars. These limitations may be waived if, in the judgment of the Port Construction Representative, workability and methods of consolidation are such that the concrete can be placed without honeycomb or voids.

M. **Use of Admixtures:**

1. Water-reducing admixtures may be added to improve workability or reduce the amount of water required for hydration according to manufacturer specifications.
2. Use of an accelerator is permitted when the air temperature is less than 40 degrees F.
3. All concrete placed in slabs when the ambient temperature is 85 degrees F., or higher, shall contain a set-retarding admixture.
4. Amounts of admixtures to be added to the mix shall be in accordance with the manufacturer's instructions to achieve the desired results.
PART 3  EXECUTION

3.1 FORMS

A. General:

1. Forms shall conform to the shape, lines and dimensions of the concrete as called for on the Drawings and shall be sufficiently tight to prevent leakage of mortar. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall have sufficient rigidity to maintain specified tolerances. Forms placed on successive units for continuous surfaces shall be fitted to accurate alignment to assure a smooth completed surface area free from irregularities.

2. Earth cuts shall not be used to form vertical surfaces unless so indicated on the Drawings or in the Technical Specifications, or unless approved by the Port Construction Representative.

3. Drawings of complex or prefabricated forming systems shall be submitted for review. Since formwork is the Contractor's responsibility, these Drawings will not be approved or disapproved, but are submitted for information and comments only.

B. Design and Installation of Formwork:

1. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.

2. The formwork shall be designed for the loads, lateral pressure, and allowable stresses outlined in Chapter 1, Design, of "Recommended Practice for Concrete Formwork" (ACI 347).

C. Chamfer Strips: Chamfer strips shall be placed in the corners of forms to produce a 3/4" bevel or radius on all exterior corners.

D. Form Ties: Bolts and rods or rigid metal form ties of an approved type which are especially designed for use in connection with concrete work shall be used for temporary internal ties. They shall be coated with grease and so arranged that when the forms are removed no metal will be within one inch of any concrete surface. Wire ties will be permitted only for minor or special form areas where the use of rigid type metal ties would be impracticable. Wire ties will not be permitted where the concrete surface will be exposed to weathering, or at any point where discoloration will be objectionable.

E. Camber: To maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete.

F. Adjustment: Positive means of adjustment (wedges or jacks) of shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Wedges shall be secured in position after final adjustment. Forms shall be securely braced against lateral deflections.

G. Inspection: Temporary openings shall be provided at the base of column forms and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
H. Formwork: Formwork shall be so anchored to shores or other supporting surfaces or members that upward or lateral movement of any part of the formwork system during concrete placement will be prevented.

I. Preparation of Form Surfaces:

1. All surfaces of forms and embedded material shall be cleaned of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed in them.

2. Before placing of either the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an approved coating material that will effectively prevent absorption of moisture and prevent bond with the concrete, and will not stain the concrete surfaces. A field applied form release agent or sealer of approved type or a factory applied non-absorptive liner may be used.

3. Excess form coating material shall not be allowed to stand in puddles in the forms nor shall such coating be allowed to come in contact with hardened concrete against which fresh concrete is to be placed.

J. Unless otherwise specified, the following tolerances shall govern:

Tolerances for Formed Surfaces

1. Variation from plumb: In the lines and surfaces of columns, piers, walls, and in arises:
   - In any 10 ft. of length ............................................................... 1/4 inch
   - Maximum for the entire length .......................................................... 1 inch
   a. For exposed corner columns, control-joint grooves, and other conspicuous lines:
      - In any 20 ft. length ............................................................... 1/4 inch
      - Maximum for the entire length .......................................................... 1/2 inch

2. Variation from the level or from the grades specified in the concrete documents:
   a. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores:
      - In any 10 ft. of length ............................................................... 1/4 inch
      - In any bay or in any 20 ft. length ..................................................... 3/8 inch
      - Maximum for the entire length .......................................................... 3/4 inch
   b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
      - In any bay or in 20 ft. length ............................................................... 1/4 inch
      - Maximum for the entire length .......................................................... 1/2 inch
   c. Variation of the linear building lines from established position in plan and related position of columns, walls, and partitions:
      - In any bay ............................................................... 1/2 inch
      - In any 20 ft. of length ............................................................... 1/2 inch
      - Maximum for the entire length .......................................................... 1 inch
      - Variation in the sizes and location of sleeves, floor openings, and wall openings ..................................................... 1/8 inch
   d. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:
      - Minus ............................................................... 1/4 inch
      - Plus ............................................................... 1/2 inch
e. Footings:
   1) Variations in dimensions in plan:
      Minus ...................................................................... 1/2 inch
      Plus .......................................................................... 2 inches
   2) Misplacement or eccentricity:
      2 percent of the footing width in the direction
      of misplacement but not more than ....................... 2 inches
f. Thickness:
   Decrease in specified Thickness ........................................ 5 percent
   Increase in specified Thickness .......................................... No limit
g. Variation in steps:
   1) In a flight of stairs:
      Rise ........................................................................ 1/8 inch
      Tread ...................................................................... 1/4 inch
   2) In consecutive steps:
      Rise ........................................................................ 1/16 inch
      Tread ...................................................................... 1/8 inch
h. For distances less than the 10 and 20 foot distances shown above, the
   tolerances specified shall be reduced directly in proportion to the
   tolerances shown, down to a minimum tolerance of 1/8 inch.

3.2 REMOVAL OF FORMS AND FALSEWORK

A. General: Forms and falsework shall not be removed without the approval of the Port Construction Representative. The removal of forms and falsework shall be accomplished in such a manner as to prevent injury to the concrete. All forms shall be removed before completion of the work; if necessary, temporary access openings shall be provided for removal of forms from otherwise inaccessible places. The size and method of closing such openings shall be approved by the Port Construction Representative.

B. Removal of Side Forms: Except as hereinafter provided, forms may be removed from the sides of beams, columns, and walls, and from other parts of formwork not supporting the weight of the concrete when the concrete has been cured for 24 hours.

C. Other Formed Surfaces: All other formed surfaces may have their forms and falsework removed after the concrete has achieved the required seven-day compressive strength, but in no case until the concrete has been cured for four days.

D. Removal Strength: When removal of formwork or reshoring is based on the concrete reaching a specified strength, the concrete shall be presumed to have reached this strength only when test cylinders, field cured along with the concrete they represent, have reached the strength specified for removal of formwork. The cost of testing shall be borne by the Port of Houston Authority; however, the Contractor is responsible for making and providing the cylinders to the testing laboratory.

3.3 CONSTRUCTION JOINTS

A. Joints not shown in the Contract Documents shall be so made and located as least to impair the strength of the structure and shall be approved. In general, they shall be located near the middle of the spans of slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs.
Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

B. All reinforcement shall be continued across joints. Keys and dowels shall be provided as directed by the Port Construction Representative. Longitudinal keys at least 1-1/2 in. deep and one-third the width of the member shall be provided in all joints in walls and between walls and slabs or footings. Slab joints shall also be keyed.

C. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed prior to placing adjoining concrete.

D. When required or permitted, bond shall be obtained by the use of an approved adhesive or by roughening the surface of the concrete to expose the aggregate and remove laitance or damaged concrete.

3.4 EXPANSION JOINTS

A. Reinforcement or other embedded metal items bonded to the concrete (except dowels bonded on only one side of joints) shall not be permitted to extend continuously through any expansion joint.

B. Premolded expansion joint filler shall be of the type required by the Technical Specifications and shall conform to one of the following:

3. Unless specified in more detail in the Technical Specifications or on the Drawings, joint sealer shall conform to ASTM D1190. Joint sealer shall be compatible with the joint filler specified.

3.5 EMBEDDED ITEMS

A. All sleeves, inserts, anchors, conduits and embedded items required for adjoining work or for its support shall be placed prior to concreting. Such items shall be accurately positioned and secured against displacement. Voids in sleeves inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete. Embedded steel items projecting from or within three inches of the edge of the concrete shall be galvanized or shall be stainless steel, as indicated in the Drawings or Technical Specifications. Embedded steel items no closer than three inches from the edge of concrete are not required to be galvanized.

3.6 PRODUCTION OF CONCRETE

A. Ready-Mix Concrete:

1. Except as otherwise provided in these Specifications ready-mixed concrete shall be batched, mixed and transported in accordance with "Specifications for Ready-Mixed Concrete” (ASTM C94). Plant equipment and facilities shall conform to the "Check List for Certification of Ready Mixed Concrete Production Facilities" of the National Ready Mixed Concrete Association.
2. Discharge of the concrete shall be completed within sixty minutes after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregate.

B. Site-Mixed Concrete:

1. Batching:
   a. Scales for weighing concrete ingredients shall be accurate when in use within 0.4 percent of their total capacities. Standard test weights shall be available to permit checking scale accuracy.
   b. Operation of batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances:
      1) Cement: 1 percent.
      2) Water: 1 percent.
      3) Aggregates: 2 percent.
      4) Admixtures: 3 percent.
   c. Each batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregates. Water shall continue to flow for a period which may extend to the end of the first 25 percent of the specified mixing time. Controls shall be provided to prevent batched ingredients from entering the mixer before the previous batch has been completely discharged.

2. Mixing:
   a. The concrete shall be mixed in a batch mixer capable of thoroughly combining the aggregates, cement, and water into a uniform mass within the specified mixing time, and of discharging the concrete without harmful segregation. The mixer shall bear a manufacturer's rating plate indicating the rated capacity and the recommended revolutions per minute and shall be operated in accordance therewith.
   b. Mixers with a rated capacity of 1 cu. yd. or larger shall conform to the requirements of the Plant Mixer Manufacturers Division of the Concrete Plant Manufacturers Bureau.
   c. Except as provided below, batches of 1 cu. yd. or less shall be mixed for not less than 1 min. The mixing time shall be increased 15 sec. for each cubic yard or fraction thereof of additional capacity. Shorter mixing time may be permitted provided performance tests made in accordance with ASTM C-94 indicate that the time is sufficient to produce uniform concrete.
   d. Controls shall be provided to ensure that the batch cannot be discharged until the required mixing time has elapsed. At least three-quarters of the required mixing time shall take place after the last of the mixing water has been added.
   e. The interior of the mixer shall be free of accumulations that will interfere with mixing action. Mixer blades shall be replaced when they have lost 10 percent of their original height.

3. Control of Admixtures:
   a. Air-entraining admixtures and other chemical admixtures shall be charged into the mixer as solutions and shall be measured by means of
an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water. Admixtures that cannot be added in solution may be weighed or may be measured by volume if so recommended by the manufacturer.

b. If two or more admixtures are used in the concrete, they shall be added separately to avoid possible interaction that might interfere with the efficiency of either admixture or adversely affect the concrete.

c. Addition of retarding admixtures shall be completed within 1 min. after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first.

4. Tempering and Control of Mixing Water:

a. Concrete shall be mixed only in quantities for immediate use. Concrete which has set shall not be retempered, but shall be discarded.

b. When concrete arrives at the project with slump below that suitable for placing, as indicated by the specifications, water may be added only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. The water shall be incorporated by additional mixing equal to at least half of the total mixing required. An addition of water above that permitted by the limitation on water-cement ratio shall be accompanied by a quantity of cement sufficient to maintain the proper water-cement ratio. Such addition shall be authorized by the Port Construction Representative or his representative.

3.7 PLACING

A. Preparation before Placing:

1. Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.

2. Formwork shall be completed; water and construction debris shall be removed; reinforcement shall be secured in place; expansion joint material, anchors and other embedded items properly located and secured prior to placing concrete. The Contractor shall give the Port Construction Representative sufficient advance notice that those items may be inspected and approved before concrete placement begins.

3. Subgrade shall be dampened prior to placement, but without puddles, muddy or soft places.

4. Concrete shall not be placed on frozen or frosty ground or in forms containing ice, frost or snow.

5. Pipes buried under concrete construction shall have satisfied all required tests before the concrete is placed.

B. Conveying:

1. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

2. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or
work day. Conveying equipment and operations shall conform to the following additional requirements.

a. Truck mixers, agitators, and non-agitating units and their manner of operation shall conform to the applicable requirements of "Specifications for Ready-Mixed Concrete" (ASTM C94).

b. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An approved arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.

3. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical and 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 ft. long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

4. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.

C. Depositing:

1. General: Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as shown in the contract documents or as approved. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.

2. Placing: Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.

3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.

4. Consolidation:

a. All concrete shall be consolidated by vibration, spading, rodding and forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 8000 vibrations per min. and sufficient amplitude to consolidate the concrete effectively. They shall be operated by competent workmen. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 inches apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not sufficient to cause...
segregation, generally from 5 to 15 sec. A spare vibrator shall be kept on the jobsite during all concrete placing operations. Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented if necessary by spading to work the coarse aggregate back from the formed surface.

b. Any placing or finishing operation requiring more than ten hours or night work shall have prior approval of the Port Construction Representative. Nighttime operations shall be adequately lighted.

c. Concrete shall not be dropped freely more than five feet in unexposed work or more than three feet in exposed work. Where greater drops are required, especially in columns and drilled shafts, an approved tremie or other suitable method shall be employed to lower the concrete into place.

d. Grade strips (screeds) shall be set at the proper elevations. They shall be substantial enough to maintain their proper position during placement of concrete. Screeds and grade strips shall be removed after finish has been applied. Voids remaining shall be filled with stiff concrete tamped into place. Finish to make surface uniform with adjacent areas.

D. Protection:

1. Unless adequate protection is provided and approval is obtained, concrete shall not be placed during rain, sleet, or snow.

2. Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish.

E. Placing Temperature: When the temperature of the surrounding air is expected to be below 40 degrees F. during placing or within 24 hrs. thereafter, the temperature of the plastic concrete, as placed, shall be no lower than 55 degrees F. for sections less than 12 inches in any dimension nor 50 degrees F. for any other sections. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints, and should not exceed 90 degrees F. When the temperature of the concrete exceeds 90 degrees F., precautionary measures approved by the Port Construction Representative shall be put into effect. When the temperature of the steel is greater than 120 degrees F., steel forms and reinforcement shall be sprayed with water just prior to placing the concrete. Salt, chemicals or other foreign materials shall not be added to the concrete for the purpose of preventing freezing.

F. Bonding:

1. The surface of joints shall be prepared in accordance with one of the methods specified in Section 3.3, CONSTRUCTION JOINTS. Forms shall be tight against previously placed concrete.

2. The hardened concrete of joints shall be dampened (but not saturated) and then thoroughly covered with a coat of cement grout of proportions similar to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least 1/2 in. thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained its initial set.

3. Joints receiving an adhesive shall have been prepared and adhesive applied in accordance with the manufacturer’s recommendations prior to placing of fresh concrete.
G. Concreting under Water: When required or permitted, concrete shall be deposited under water by an approved method in such a way that the fresh concrete enters the mass of previously placed concrete from within, causing water to be displaced with minimum disturbance at the surface of the concrete.

3.8 REPAIR OF SURFACE DEFECTS

A. General: Surface defects, including tie holes, unless otherwise specified by the contract documents, shall be repaired immediately after form removal.

B. Repair of Defective Areas:

1. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary the edges shall be perpendicular to the surface or slightly undercut. No featheredges will be permitted. The area to be patched and an area at least 6 in. wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.

2. The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. Cement shall be the same used in the concrete. The quantity of mixing water shall be no more than necessary for handling the placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

3. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hr. before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.

C. Tie Holes: After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.

D. Proprietary Materials: If permitted or required, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer’s recommendations.

3.9 FINISHING OF CONCRETE SURFACES

A. After removal of forms and patching defects, the surfaces of concrete shall be given one or more of the following treatments. Locations of the various finishes shall be as indicated elsewhere or as follows:

1. Rough Form Finish: For surfaces not exposed to view such as under wharves; grade beams and retaining walls receiving backfill; and areas to receive another finish material such as masonry.
2. Smooth Form Finish: For areas exposed to view but not requiring rubbed finish such as exposed face of grade beams and retaining walls, or other areas as directed in the Technical Specifications.

3. Rubbed Finish: Exposed surfaces such as columns, building walls, spandrel beams, frontal beams and columns on walls, and retaining walls at loading docks.

4. Scratch Finish: For slabs to receive later topping course.

5. Floated Finish: For surface to receive roofing or waterproofing membrane and wharf decks with earth fill.

6. Troweled Finish: For interior floors intended as walking surfaces or for reception of floor finish. Consolidate the concrete surface by the final hand troweling operation, free from trowel marks, uniform in texture and appearance, and with a surface plan tolerance not exceeding 1/8 in 10 ft – 0 in. straightedge.

7. Broom or Belt Finish: For wharf decks, loading platforms, warehouse and transit shed floors, and other exterior slab surfaces.

B. Finishing Tolerances:

1. Finishes with Class A tolerances shall be true planes within 1/8 in. in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.

2. Finishes with Class B tolerances shall be true planes within 1/4 in. in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.

3. Finishes with Class C tolerances shall be true planes within 1/4 in. in 2 ft. as determined by a 2 ft. straightedge placed anywhere on the slab in any direction.

C. Description of Finishes:

1. Rough Form Finish: No form facing materials are required for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4 in. in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.

2. Smooth Form Finish: The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-trade hardboard, metal plastic, or other approved material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.

3. Rubbed Finish: Rubbed finish shall be produced on concrete with a smooth form finish as soon as possible after forms are removed and patching is completed. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced. No cement grout shall be used other than the cement paste drawn from the concrete itself by the rubbing process. After the paste has reset, the surface shall be washed with clean water.

4. Scratched Finish: After the concrete has been placed, consolidated, struck off, and leveled to a Class C tolerance, the surface shall be roughened with stiff brushes or rakes before final set.
5. Floated Finish: After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. During or after the first floating, planeness of surface shall be checked with a 10-ft. straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a surface within Class B tolerance throughout. The slab shall then be refloated immediately to a uniform sandy texture.

6. Troweled Finish: The surface shall first be float-finished as specified in Section 3.9 C. Floated Finish. It shall next be power troweled, and finally hand troweled. The first troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks, uniform in texture and appearance and shall be plane to a Class A tolerance, except tolerance for concrete on metal deck shall be Class B. On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

7. Broom or Belt Finish: Immediately after the concrete has received a float finish, as specified in Section 3.9 C. Floated Finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

3.10 CURING AND PROTECTION

A. General: Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to approval. Poor procedures or materials shall be cause for the Port Construction Representative to stop all concrete work on the project until proper provisions for curing are made.

B. Preservation of Moisture: For concrete surfaces not in contact with forms one of the following procedures shall be applied immediately after completion of placement and finishing:

1. Ponding or continuous sprinkling.
2. Application of absorptive mats or fabric kept continuously wet.
3. Application of sand kept continuously wet.
4. Continuous application of steam (not exceeding 150 degrees or mist spray.
6. Application of other moisture-retaining covering as approved.
7. Application of a curing compound conforming to "Specifications for Liquid Membrane-Forming Compounds for Curing Concrete" (ASTM C-309) and containing a light-colored fugitive dye. The compound shall be applied in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. It shall not be used on any surface against which additional concrete or other material is to be bonded unless it is proven that the curing compound will not prevent bond, or unless positive measures are taken to remove it completely from areas to receive bonded applications.
C. Moisture Loss: Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal the concrete shall be cured until the end of the prescribed curing time by one of the methods of Paragraph Preservation of Moisture.

D. Curing Time:

1. Concrete shall be cured a minimum of 4 days, except suspended structural slabs shall be cured 7 days. Where high-early-strength cement has been permitted, curing time shall be 3 days. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, curing may be terminated when the average compressive strength has reached 70 percent of the specified 28 day strength. If one of the curing procedures of Section 3.10 B., Preservation of Moisture, Items 1 through 4 above is used initially, it may be replaced by one of the other procedures any time after the concrete is one day old, provided the concrete surface is not permitted to become dry during the transition.

2. The length of time the concrete has been cured in the structure shall be determined by the cumulative number of days or fractions thereof, not necessarily cumulative, during which the temperature of the air in contact with the concrete is above 50 degrees F. and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

E. Temperature, Wind and Humidity:

1. Cold Weather: When the mean daily outdoor temperature is less than 40 degrees F., the temperature of the concrete shall be maintained between 50 degrees F. and 70 degrees F. for the required curing period. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hrs. unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

2. Hot Weather: When necessary, provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

3. Rate of Temperature Change: Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5 degrees F. in any 1 hr. or 50 degrees F. in any 24-hr. period.

F. Protection from Mechanical Injury: During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.
3.11 QUALITY ASSURANCE

A. Provide necessary controls during evaluation of materials, mix designs, production and delivery of concrete, placement and compaction to assure that the Work will be accomplished in accordance with Contract Documents. Maintain records of concrete placement. Record dates, locations, quantities, air temperatures, and test samples taken.

B. Concrete construction for buildings shall conform to ACI 318.

3.12 SAMPLING AND TESTING FOR CONCRETE

A. Concrete testing required in this section will be performed by an independent commercial testing laboratory employed and paid by the Port of Houston Authority, except as set out herein, in accordance with Material Testing in the General Conditions. Tests to be made at the Port of Houston Authority's expense shall be ordered by the Port Construction Representative only, and not by the Contractor.

B. Standard Services: The testing agency will perform the following services:

1. Verification that plant equipment and facilities conform to NRMCA "Certification of Ready-Mix Concrete Production Facilities".
2. Testing of proposed materials for compliance with this Specification.
3. Review of proposed mix design submitted by Contractor.
4. Obtaining production samples of materials at plants or stockpiles during work progress and testing for compliance with this Specification.
5. Strength testing of concrete according to following procedures:
   a. Obtaining samples for field test cylinders from every 100 cubic yards and any portion less than 100 cubic yards for each mix design placed each day, according to ASTM C 172, with each sample obtained from a different batch of concrete on a representative, random basis. Selecting test batches by any means other than random numbers chosen before concrete placement begins is not allowed.
   b. Molding four specimens from each sample according to ASTM C 31, and curing under standard moisture and temperature conditions as specified in Sections 7(a) and (b) of ASTM C 31.
   c. Testing two specimens at 7 days and two specimens at 28 days according to ASTM C 39, reporting test results averaging strengths of two specimens. However, when one specimen evidences improper sampling, molding or testing, it will be discarded and remaining cylinder considered test result. When high-early-strength concrete is used, specimens will be tested at 3 and 7 days.

6. Air Content: For each strength test, determination of air content of normal weight concrete according to ASTM C 231.
7. Slump: For each strength test, and whenever consistency of concrete appears to vary, conducting slump test in accordance with ASTM C 143.
8. Temperature: For each strength test, checking concrete temperature in accordance with ASTM C 1064.
9. Lightweight Concrete: For each strength test, or more frequently when requested by City Engineer, determination of air content by ASTM C 567 and unit weight by ASTM C 567.
10. Monitoring of current and forecasted climatic conditions to determine when rate of evaporation, as determined by Figure 2.1.5 of ACI 305R, will produce loss of 0.2 pounds of water, or more, per square foot per hour. Testing lab representative will advise Contractor to use hot weather precautions when such conditions will exist during concrete placement, and note on concrete test reports when Contractor has been advised that hot weather conditions will exist.

11. Class A and D Concrete Shrinkage Tests: Performance of drying shrinkage tests for trial batches as follows:
   a. Preparation and Testing of Specimens: Compression and drying shrinkage test specimens will be taken in each case from the same concrete sample; shrinkage tests will be considered a part of the normal compression tests for the project. 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157, modified as follows:
      1) Wet curing: Remove specimens from molds at an age of 23 hours + 1 hour after trial batching and immediately immerse in water at 70 degrees F ±3 degrees F for at least 30 minutes;
      2) Measure within 30 minutes after first 30 minutes of immersion to determine original length (not to be confused with "base length");
      3) Then submerge in saturated limewater, at 73 degrees F ±3 degrees F, for 7 days;
      4) Then measure at age 7 days to establish "base length" for drying shrinkage calculations ("zero" days drying age);
      5) Calculate expansion (base length expressed as a percentage of original length);
      6) Immediately store specimens in a temperature- and humidity-controlled room maintained at 73 degrees F, ±3 degrees F and 50 percent ±4 percent relative humidity, for the remainder of the test.
      7) Measure to determine shrinkage, expressed as percentage of base length. Compute the drying shrinkage deformation of each specimen as the difference between the base length (" zero " days drying age) and the length after drying at each test age. Compute the average drying shrinkage deformation of the specimens to the nearest 0.0001-inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, disregard the results obtained from that specimen. Report results of shrinkage tests to the nearest 0.001 percent of shrinkage.
      8) Report shrinkage separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

C. Additional Testing and Quality Control Services: The following will be performed by an independent commercial testing laboratory employed and paid by the Port of Houston Authority when requested by the Port Construction Representative.

   1. Checking of batching and mixing operations.
   2. Review of manufacturer’s report of each cement shipment and conducting laboratory tests of cement.
   3. Molding and testing reserve 7-day cylinders or field cylinders.
   4. Conducting additional field tests for slump, concrete temperature and ambient temperature.

D. Authority of the Testing Agency: Representatives of the agency shall inspect, sample and test the materials and monitor the production of concrete as required by the Port Construction Representative. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing agency shall report such deficiency to the Port Construction Representative and the Contractor. The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the contract documents, nor to approve or accept any part of the work.

E. Contractor's Responsibility:

1. It shall be the responsibility of the Contractor to furnish materials and construction in full compliance with the contract documents. As specified previously, he shall submit mix design and representative samples for approval.
2. To facilitate testing and inspection, the Contractor shall furnish any necessary labor to assist the designated testing agency in obtaining and handling samples at the project or other sources of materials. He shall cooperate fully with the laboratory and the Port Construction Representative and shall correct or replace any defective work.
3. The Contractor shall employ an independent commercial testing laboratory, acceptable to the Port of Houston Authority, and shall pay the costs of laboratory services required to establish mix designs for Portland cement concrete. The Contractor shall pay for the costs of analyzing aggregates, fixing gradations, preparing and testing of design cylinders or specimens and other such services required to establish mix design, or to redesign any mix when required due to any change in source of materials or other conditions.
4. The Contractor shall notify the commercial testing laboratory employed by the Port of Houston Authority 24 hours prior to placing concrete to allow for completion of quality tests and for the assignment of personnel.

F. Testing of Deficient Concrete in Place:

1. When averages of three consecutive strength test results fail to equal or exceed specified strength, or when any individual strength test result falls below specified strength by more than 500 psi, strength of concrete shall be considered potentially deficient and core testing, structural analysis or load testing may be required by Port Construction Representative.
2. When concrete in place proves to be deficient, Contractor shall pay costs, including costs due to delays, incurred in providing additional testing and analysis services provided by the Port Construction Representative, or the independent commercial testing laboratory selected by the Port of Houston Authority.
3. Replace concrete work judged inadequate by core tests, structural analysis or load tests at no additional cost to the Port of Houston Authority.
4. Core Tests:
   a. Obtain and test cores in accordance with ASTM C 42. Where concrete in
      structure will be dry under service conditions, air dry cores (temperature
      60 to 80 degrees F, relative humidity less than 60 percent) for 7 days
      before test; test dry. Where concrete in structure will be more than
      superficially wet under service conditions, test cores after moisture
      conditioning in accordance with ASTM C 42.
   b. Take at least three representative cores from each member or area of
      concrete in place that is considered potentially deficient. Location of
      cores shall be determined by the Port Construction Representative so as
      to least impair strength of structure. When, before testing, one or more
      cores shows evidence of having been damaged during or after removal
      from structure, replace the damaged cores.
   c. Concrete in area represented by core test will be considered adequate
      when average strength of cores is equal to at least 85 percent of
      specified strength, and when no single core is less than 75 percent of
      specified strength.
   d. Patch core holes in accordance with the guidelines of this specification.

5. Structural Analysis: When core tests are inconclusive or impractical to obtain, the
   Port Construction Representative may perform additional structural analysis at
   Contractor's expense to confirm safety of structure.

6. Load Tests: When core tests and structural analysis do not confirm safety of
   structure, load tests may be required, and their results evaluated, in accordance
   with ACI 318.

7. Testing by impact hammer, sonoscope, probe penetration tests (Windsor probe),
   or other nondestructive device may be permitted by the Port Construction
   Representative to determine relative strengths at various locations in structure, to
   evaluate concrete strength in place, or for selecting areas to be cored. However,
   such tests, unless properly calibrated and correlated with other test data, shall
   not be used as basis for acceptance or rejection of structure's safety.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 13 13.01 Add - ROLLER COMPACTED CONCRETE PAVEMENT

PART 1  GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes furnishing plant, labor, materials, equipment, and services necessary to perform the operations in connection with the installation of Roller Compacted Concrete as specified in this Section and as indicated on the Contract Drawings. Hereinafter, within this specification section, roller compacted concrete will be referred to as RCC.

B. Related Work specified elsewhere.

1. Section 32 11 33.00 - Cement Treated Base Courses
2. Section 32 13 13.02 - Concrete Pavement
3. Section 32 12 16.00 – Hot Mix Asphalt Pavement

1.2 SUBMITTALS

A. The following shall be submitted in conformance with the requirements of the General and Special Conditions.

1. Contractor shall provide documentation for examples of experience with Roller Compacted Concrete Pavement from previous projects of similar nature and scope. Contractor's experience will be evaluated during the pre-bid process.

2. A copy of the cement test report proving compliance ASTM C 150 shall be submitted to the Engineer for forwarding to the Port Authority's testing laboratory.

3. A list of equipment proposed for use to perform the placing of RCC shall be submitted to the Engineer prior to utilization on the job. The list shall include pavers equipped with dual tamping bars and high density vibrating screeds.

4. A copy of the job mix formula and test data shall be submitted to the Engineer for approval no less than 30 calendar days prior to beginning paving operations. An approved independent testing laboratory shall prepare the mix design based on the specified performance requirements. Mix design shall show details of cementitious materials, 7, 14, 21 and 28-day compressive and flexural strengths, including a time / strength curve diagram for the proposed mix and required density after placement, all with certification by a registered professional engineer. Mixture design shall identify the quantity and gradation of aggregate, the optimum moisture content, and the amount of portland cement, other cementitious material and the total cementitious materials required per cubic yard of the concrete. The mix design shall be done in a similar fashion to determine the relationship between moisture content and the unit weight of soil and soil aggregate mixture. Design mix shall specify the
proportions of each material (aggregate, cement, water, add mixtures) in the mix in terms of pound per cubic yard.

5. Submit details of the following:
   a. Contractor's construction schedule for RCC work.
   b. Lay down pattern showing:
      (1) direction of paver,
      (2) paving width,
      (3) daily production,
      (4) curing method and pattern, and
      (5) planned longitudinal and transverse cold joints
   c. Certification that aggregates meet the specified requirements
   d. Manufacturer's data and specifications for mixing plant, hauling, placing, spreading and compaction equipment
   e. Layout of plant showing location of each aggregate storage bin, each cementitious material bin, water supply and mixing plant
   f. Methods of handling, storing, delivering and mixing of materials.
   g. Procedure for placing, compacting, and curing RCC
   h. Procedure for monitoring the concrete heat of hydration during placement and curing

B. If placement conditions and ambient temperature could result in concrete temperatures exceeding 90 degrees F. or less than 40 degrees F., Contractor is to submit details for such hot-weather placement or cold-weather placement.

1.3 MEASUREMENT AND PAYMENT

A. Mobilization for RCC Pavement will be on a Lump Sum basis including set-up for batch plant and related permits; for preparation of mix designs and test strips; and for all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work.

B. Subject to Section III. Roller compacted Concrete pavement shall be measured by the square yard of surface area at the depth specified on the plans of completed and accepted pavement.

1. The quantity of roller compacted concrete pavement measured as set out above shall be paid for at the unit price per square yard for “Roller Compacted Concrete Pavement” and the thickness indicated, which price shall be full compensation for shaping and fine grading the underlying pavement course; for furnishing and placing all expansion joints, sawed joints, construction joins, joint sealants, other type required joints, or load bearing devices. No separate payment will be made for any of these items or the pavement construction. The payment for the items shall be included in the unit price per square yard of “Roller Compacted Concrete Pavement” at the depth indicated.

1.4 REFERENCE STANDARDS

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)


ASTM D 558 (Modified)- Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures (Modified to use 6-inch mold, 10-pound hammer, 18-inch drop height, four layers, and 118 blows per layer)

ASTM D977-98 - Standard Specification for Emulsified Asphalt

ASTM C 42/C 42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

ASTM C 1435 (Modified) - Standard Practice for Molding Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Hammer (Modified to use five equal lifts)

ASTM C 39/C39 M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM C 1040 - Standard Test Methods for In-Place Density of Unhardened and Hardened Concrete, Including Roller Compacted Concrete, By Nuclear Methods

1.5 QUALITY CONTROL

A. The Contractor shall provide any and all quality control (QC) testing that deems necessary to properly control the quality, consistency, and uniformity of the RCC produced and placed. The Contractor shall perform daily moisture checks of the aggregate and gradation of the aggregate. Daily moisture and gradation checks to verify job mix design are required for this contract. If the Contractor chooses to conduct quality control tests, the information and data determined through that testing shall be available for inspection by Construction Manager upon request. The Contractor shall provide weighing equipment capable of being calibrated and print out batch weights. Tickets will be required for every load. In no case shall the Contractor's quality control test data be used by the Construction Manager for payment purposes.

B. The Contractor shall be responsible for developing the RCC mix specified herein.

C. Contractor shall allow Construction Manager to the mixing plant for verification of weights or proportions and character of material in the preparation of RCC mix.

D. Inspection or testing by the Construction Manager will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

1.6 QUALITY ASSURANCE / ACCEPTANCE CRITERIA

A. The Contractor shall provide safe and convenient access, acceptable to the Construction Manager, for inspection and sampling of the RCC and shall cooperate in the inspection and sampling process when requested to do so.

B. The Contractor shall have major equipment items such as batch plant, rollers, pavers, trucks and similar items, available for inspection by the Port Authority's Representatives. Deficiencies in quality, quantity, or types of equipment shall be corrected prior to starting work. This inspection and approval shall in no way
relieve the Contractor from the obligation to provide the equipment required to perform the work.

C. RCC plant inspections will be conducted at random to check the settings, operation, materials and mixture produced. The Construction Manager will order the plant shut down if deficiencies are found, such as deviation from approved job-mix formula, segregation in the mix, or inconsistent plant operation. The Contractor shall provide to the satisfaction of the Construction Manager his corrective actions prior to re-starting production.

D. The optimum moisture density relationship of the RCC shall be determined in accordance with ASTM D 558 using the approved design mix. The cylindrical test specimens shall be molded using ASTM C 1435/C 1435M -05. The moisture content of the material placed shall be between optimum and +2.0 percent of optimum. Determination of the degree of compaction in the field will be based on the maximum wet density as determined by ASTM D558 as modified by this Section.

E. Three 6 inch diameter cores (ASTM C42) will be taken from each 7,000 square feet, or less, of RCC area. A deficiency shall exist if the average thickness for the area is less than the design thickness by 0.5 inch or more.

F. Three 6 inch diameter cores (ASTM C42) will be taken after 7 days from each 7,000 square feet or less of RCC area to check that no separation occurred between lifts. One (1) core equals both top and bottom full depth cored and the combined average of the two. If one or more of the cores reveal separation between lifts, two additional cores per area shall be taken at the Contractor's expense until bonding can be verified by additional coring. If one or more of the additional cores reveal separation between lifts, the RCC placed within the affected area shall be rejected and the Contractor will be required to remove all the defective material. Separation shall be defined as when a core separates at the joint during normal handling, during or after coring.

G. The RCC will be sampled from materials being incorporated into the work and the laboratory specimens will be produced in accordance with ASTM C 1435 modified to use five equal lifts. Four specimens from each 4 hours of production, or part thereof for any individual plant, or from every 10,000 cubic feet produced, or part there of, which ever is lower, will be tested in unconfined compression after 7 days moist curing in accordance with ASTM C 39. This test will be used to check if the material placed meets the requirements of the approved job mix formula. If the test results indicate the specification requirements are not met, the Port Authority's representative will suspend placement until all the necessary action including a new job mix formula is developed and approved by the Port Authority's Representative.

H. A minimum of three field density and moisture content samples will be taken every 7,000 square feet. The average in place field density determined in accordance with ASTM D 2922 or ASTM C 1040 shall be not less than 98% of maximum laboratory density with no individual test below 96%.

I. RCC pavement strengths will be based on the average of three cores per 7,000 square feet, or less, with no single core below 90% of the specified 7 day compressive strength in accordance with ASTM C42 / C42M from each 7,000
square feet or less of RCC area. Minimum compression strength is 90% of 3,500 which is 3,150 for a single core.

1. Obtaining and testing of 3 cores of RCC for compressive strength determination shall be performed in accordance with ASTM C42/C42M.

2. The Contractor shall fill the core holes with Portland cement concrete as directed by the Engineer. Concrete shall meet the requirements of Section 32 13 13.00 - Concrete Pavement of this specification. Reinforcement shall not be required and thickness shall be as specified for RCC and core holes are to be filled to be flush with surrounding pavement surface.

J. Surface Tolerance shall be a 1/4-inch maximum variation, under a 20-foot straightedge. Surface texture shall be tight. Grinding of the surface to achieve tolerance is allowed, provided grinding does not create deviation from other tolerances.

K. Grade Tolerance shall be 1/10-inch maximum variation above designated elevation and 1/3-inch variation below designated elevation. The surface of the underlying material shall be finished to the necessary grades such that when the required thickness of RCC is placed, the pavement surface will meet the indicated grades.

L. Before the paving work starts, the Contractor and the Port Authority will jointly agree on an independent testing laboratory that shall be used to determine the RCC mix, thickness, bonding, and strength of the RCC when there is disagreement over the results of any tests completed by the Construction Manager. The Independent testing shall be AASHTO accredited, and approved by PHA. The tests shall be done within seven days after the failed 7-day core test. Three cores shall be taken from the RCC area represented by a failed core test. The strength shall be compared to the adjusted strength calculated based on the approved job mix formula.

1.7 EQUIPMENT

A. The Contractor shall provide and maintain in operating condition equipment, tools, and machines used in the performance of the work.

B. The Contractor, when submitting his bid for work under this contract, shall at the same time submit a list of equipment available and ready for use on the contract and he shall further certify that the equipment listed meets the requirements of this Specification.

C. Before any work is permitted to commence, the Contractor's equipment and plant will be carefully inspected and should any of it fail to meet the required standards. Work will not be permitted to start until all such deficiencies have been corrected.

D. The Construction Manager shall have access at all times to any plant, equipment or machinery to be used on this contract in order to check calibration, control or operating adjustments. Where adjustment appears necessary, a competent technician, or instrument repair laboratory is to carry out the necessary adjustment(s).
E. Walk-behind, or similar sized vibratory rollers and mechanical tampers shall be furnished for use in compaction areas inaccessible to the large rollers.

1.8 DELIVERY AND STORAGE

A. Unload cementitious materials and store in weather tight bins or silos that protect them from dampness and contamination and provide easy access for inspection and identification of each shipment.

B. Stockpile a minimum of 25 percent of total required amount of each size of aggregate prior to commencing mixing operation.

C. Store curing compounds and miscellaneous materials as recommended by Manufacturer.

PART 2 PRODUCTS

A. Portland cement shall conform to ASTM C 150, Type I.

B. Water shall be clean, clear, and free of substances deleterious to the hardening and performance of RCC mixture.

C. Changes to RCC mix shall be approved by the Engineer. Should a change in material source be proposed, the Engineer must approve a new mix design.

D. All RCC construction shall be completed using two lift placement.

E. Aggregate shall be clean crushed stone conforming to the requirements of Section 32 13 13.00 – Concrete Pavement. The gradation shall be well graded without gradation gaps. Contractor to provide results of tests for deleterious reactivity of aggregates in mix design as outlined in Section 32 13 13.00 – Concrete Pavement Paragraph 2.2.B. The gradation of RCC shall conform to the gradation shown in Table 1.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch</td>
<td>100%</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>70 – 90%</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>60 – 85%</td>
</tr>
<tr>
<td>#4</td>
<td>40 – 60%</td>
</tr>
<tr>
<td>#16</td>
<td>20 – 40%</td>
</tr>
<tr>
<td>#100</td>
<td>6-18%</td>
</tr>
<tr>
<td>#200</td>
<td>2-8%</td>
</tr>
</tbody>
</table>

F. At the option of the Contractor the gradation listed in Table 2 may be used for the bottom lift of the RCC placement. Use of this option will automatically require the operation of a second pugmill and the necessary quality controls to ensure that the two simultaneous mixing operations and delivery to the pavers is correct for the respective bottom and top lifts of the RCC pavement.
TABLE 2 – BOTTOM COURSE AGGREGATE GRADATION

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100%</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>90 – 100%</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>70 – 90%</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>60 – 85%</td>
</tr>
<tr>
<td>#4</td>
<td>40 – 60%</td>
</tr>
<tr>
<td>#16</td>
<td>20 – 40%</td>
</tr>
<tr>
<td>#100</td>
<td>0 – 10%</td>
</tr>
</tbody>
</table>

G. The aggregates shall not vary from low limit on one sieve to high limit on the adjacent sieve. The portion passing the No. 40 sieve shall have a liquid limit of not more than 20 and plasticity index of not more than 5. Fines shall be non-plastic.

H. RCC shall be produced with a suitable cement and cementitious material content to develop a 7-day flexural strength of not less than 550 psi and 3,500 psi compressive. Minimum cement content shall be 12% to 15%. RCC shall be produced with only sufficient moisture to allow placing, compaction and hydration of the cementitious materials.

I. Concrete curing compound shall conform to ASTM C 309.

PART 3 EXECUTION

3.1 WEATHER LIMITATIONS

A. RCC shall not be mixed or placed on a base course that is frozen or has frost, or while the atmospheric temperature is below 40 degrees Fahrenheit or when conditions indicate that the temperature may fall below 35 degrees Fahrenheit within 24 hours. It shall not be placed on an underlying layer with a temperature of less than 35 degrees Fahrenheit.

B. RCC shall not be mixed or placed when it is raining.

C. If the ambient temperature during installation exceeds 90 degrees F., Contractor is to reduce allowed compaction time to 30 minutes. Contractor is to also provide regular misting of water on the installed surface until placement of the overlying lift of concrete; or in the case of second lift (to finished grade), until the placement of curing membrane.

3.2 PREPARATION

A. When subgrade, drainage layer, and stabilized base have been placed and compacted in accordance with the Specification, notify the Construction Manager for approval. Do not place RCC until subgrade, drainage layer and stabilized base courses have been approved. Any ruts or soft yielding places or standing water shall be corrected, at no cost to PHA, before the RCC course is placed. Work shall not proceed if the underlying layer is in a condition that will result in damage by construction traffic.
B. Access routes shall be clearly marked over the area to be constructed. The surface shall be maintained in a satisfactory condition until the RCC is placed.

C. The surface shall be moistened prior to placing RCC and shall be maintained in this condition. No standing water will be permitted.

3.3 MIXING

A. The aggregate shall be proportioned and mixed with cement and water in a central mixing plant or pugmill. The plant shall be equipped with feeding and metering devices which will introduce the cement, aggregate and water in the quantities specified. Mixing shall continue until a thorough and uniform mixture has been obtained. The Contractor shall provide batch tickets with weights of all ingredients to PHA immediately after batching.

B. Batching or feeding shall conform to the mixture proportions by weight as directed within the following tolerances:

<table>
<thead>
<tr>
<th>Material</th>
<th>Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each cementitious material</td>
<td>plus or minus 2%</td>
</tr>
<tr>
<td>Water</td>
<td>plus or minus 3%</td>
</tr>
<tr>
<td>Aggregates</td>
<td>plus or minus 4%</td>
</tr>
</tbody>
</table>

C. Prior to commencement of RCC production, the Contractor shall carry out a complete and comprehensive calibration of the plant in accordance with the manufacturer’s recommended procedures. The calibration will be witnessed by the Construction Manager and shall meet with his approval. All scales, containers and other items necessary to complete the calibration shall be provided by the Contractor. After completion of the initial calibration, daily yield checks shall be carried out. A complete recalibration shall be carried out as and when directed by the Construction Manager.

D. The mix shall be discharged directly into the transporting equipment and no stockpiling will be permitted.

3.4 TEST AREA

A. Prior to commencing with production of RCC for the project, the Contractor shall construct a test area of minimum dimension of 20,000 square feet meeting the acceptance requirements indicated in the paragraph 1.6 of this Section. This test area is to be installed using the mixing plant, equipment, and methods to be used in the final construction.

B. If the test area complies with the acceptance testing, it may be incorporated into the work. If the test area does not meet acceptance requirements indicated in paragraph 1.6, the Contractor shall remove and reconstruct a new test area at no additional cost to the Port Authority.

C. The Contractor shall cooperate fully with the Construction Manager and the Field Engineer during construction and testing of test area.

D. The Contractor shall construct the test area at location selected by the Contractor and approval by the Engineer, to resolve anticipated problems with equipment, mix behavior or compaction prior to starting the paving operation.
E. Test area shall be constructed involving more than 1 lane, so that longitudinal and transverse joint finishing techniques can be established. Additionally, Contractor is to establish maximum angle for edges to be used in joint faces of cold joints.

F. During construction of test area, the Contractor shall establish optimum rolling pattern by taking nuclear density meter readings and observations to:
   1. Determine sequence and number of passes
   2. Determine correct operating characteristics of vibratory rollers
   3. Determine maximum density of RCC mix
   4. Ensure smooth surface finish
   5. Ensure proper construction of the two or more lifts.

G. Contractor shall establish actual density achieved by coring to determine if additional or other rolling equipment is required to achieve density not less than 98 percent of density samples of mix being used.

3.5 TRANSPORTATION

A. The trucks for hauling the RCC mix from the plant to the paver shall be of adequate size, speed, and condition to ensure orderly and continuous operation and shall be equipped as follows:
   1. Boxes with tight metal bottoms.
   2. Covers of sufficient size and weight to completely cover and protect RCC mix when truck is fully loaded

B. The RCC shall be transported directly from the mixer to the point where it is to be laid and shall be protected from weather both during transit and while waiting placement.

C. RCC mixture shall be transported to the site using in dump trucks with boxes cleaned out before loading. The Construction Manager may require that the trucks be provided with protective covers properly secured in place until discharge. RCC shall be loaded and transported to preclude segregation of material during transportation.

3.6 PLACING

A. The RCC mix shall be laid by mechanical grade-controlled self-powered pavers capable of spreading the RCC mix within specified tolerances, true to line, grade, and crown as indicated on the drawings.
   1. Pavers must be capable of accommodating the lift thickness specified.
   2. Pavers shall be equipped with dual tamping bars and high density vibrating screeds capable of placing the RCC mix to at least 90 percent of required density.
   3. The paver shall proceed in steady, continuous operation with minimal starts and stops except to begin a new lane. Maximum paver speed shall not exceed ten feet per minute.
   4. A small gasoline driven plate compaction device should be mounted on the outside edge of the screed so that additional compactive effort can be applied to achieve a good density for the outside edge of the

B. The RCC shall be placed and spread evenly in such a manner as to prevent segregation.
C. The RCC shall be placed to thickness, grades, and lines as indicated or as directed by the Engineer. If the plan thickness for the pavement exceeds 9 inches, the compacted layer thickness shall be one half of the plan thickness. In no case should the compacted layer thickness exceed 9 inches. The bottom layer shall be compacted to specified minimum density before the following layer is placed. The maximum placement of RCC lanes shall be at 24 foot widths.

D. Not more than 60 minutes shall elapse between the start of moist mixing and the end of compaction of any load of RCC in multi-layer construction. Where two or more layers are to be constructed consecutively, no more than 120 minutes shall elapse between the start of moist mixing of the material for the bottom layer and completion of finish, grading, and compaction of the top layer. No grading (or operating graders), compacting or finishing shall be allowed after the specified times have elapsed.

E. For multi-layer construction, the surface of the underlying layers shall be kept moist by fog-spray until covered with the next layer.

F. The level of RCC mix in the paver hopper shall not be allowed to approach empty between loads, and RCC mix shall be maintained above the auger shaft during paving.

G. The RCC mix shall be placed with the paver to a sufficient depth that will produce the specified thickness when compacted and conform to the required cross-section and grade. The paver shall be operated in a manner that will prevent segregation and produce a smooth continuous surface without tearing, pulling or shoving. The length of RCC spread shall be limited to that which can be compacted and finished within the appropriate time limit.

H. Not more than 60 minutes shall elapse between placements of RCC in adjacent lanes unless a cold joint is provided.

I. Where possible, more than one paver shall be used in staggered formation to produce multi-lane construction with minimum use of cold joints.

J. Placing shall be done in a pattern so that curing water from previous placements will not pose a runoff problem on the fresh RCC surface or on the base course.

K. In areas of less than 25 square feet adjacent to obstacles where it would be difficult to maneuver a paver such as utility access, drop inlets, manholes, or similar obstructions, the Contractor may spread RCC by hand. Spreading shall be in a manner to prevent segregation. Mixture shall be spread uniformly with shovels in a loose layer of thickness that, when compacted, will conform to density, grade, thickness, and surface texture requirements. As an alternative to the specified RCC the Contractor may place conventional concrete at the same unit rate cost as RCC. Concrete shall meet the requirements as specified in the Section 32 13 13.00 – Concrete Pavement. Steel reinforcement will not be required. Thickness will be as called in the Plans.

3.7 COMPACTION

A. Immediately upon completion of spreading of any lift of RCC, the mixture shall be thoroughly compacted. The number, type and weight of rollers shall be sufficient to compact the mixture for the full depth of the layer to the required density.
B. Compaction shall be accomplished by self-propelled vibratory steel wheel rollers and rubber-tired rollers. Rolling shall begin within 10 minutes of spreading.

C. Rolling shall be continued with the vibratory roller until a wet field density of not less than 98 percent of the maximum wet density determined by ASTM D558 as modified by this Section is met, or until no observed increase in density of material occurs.

D. A rolling pattern shall be established that will achieve the required density with a minimum number of roller passes. During vibratory compaction the roller shall not start or stop in vibratory mode. The stopping point of successive rolling passes shall be staggered to avoid forming a depression on the surface.

E. Special care shall be taken to obtain full compaction in the vicinity of both longitudinal and transverse construction joints. After compaction has been completed and prior to final set, the edges where no vertical forms have been used shall be cut back to a vertical face where the correct thickness of fully compacted RCC has been obtained.

F. The surface of any layer of RCC material shall on completion and immediately before overlaying or application of the cure coat, be well closed, free from movement under compaction equipment, and free from ridges, cracks, loose materials, pot holes, ruts or other defects. All loose, segregated or defective areas shall be removed to the full thickness of the layer and all repairs shall be in accordance with the Section titled "Repair of RCC" of this Section.

G. After compaction and grading has been completed, compacting, grading, and any other equipment, including automobiles, shall not bear on the RCC for the duration of the curing period and in no case earlier than 7 days.

H. The roller shall not operate within 2 feet of the edge of freshly placed lane until the adjacent lane is placed. Then both edges of the two lanes shall be rolled together within allowable time. If a cold joint is planned, the complete lane shall be rolled and a cold joint procedure, as specified in 3.11 "Construction Joint and Trench Joint" of this Section.

3.8 JOINTS

A. Weaken Plane Joints.

The Contractor shall saw-cut joints as shown on the plans. Soft-cut or green-cut saws require Construction Manager's approval and shall be done to manufacturer's recommendations.

B. Expansion joints shall be installed as shown on the plans.

3.9 PROTECTION AND CURING

A. The completed RCC shall be cured using a concrete curing compound conforming to ASTM C309 or ASTM D977 applied on the day of construction no later than one hour after completion of finishing operations on the surface and edges of the RCC.

B. The curing seal shall be maintained and protected for a minimum of 7 days.

C. After final rolling of the RCC, no vehicular traffic except for pneumatic-tired curing equipment or saw-cutting equipment shall be permitted on the RCC for 7 days.
D. Plastic sheeting meeting the requirements of ASTM C 171 shall be provided and kept readily available to cover pavement less than 12 hours old if rainfall occurs.

E. Suitable barriers shall be placed and maintained to protect finished RCC from equipment or vehicles.

3.10 REPAIR OF RCC

A. Repair of defective areas on the bottom layer shall be performed within 60 minutes from moist mixing and on the top layer 120 minutes from moist mixing of material for the bottom layer; otherwise repairs shall be done within 7 days after completion of placement of RCC. All repairs will be subject to Port Authority's approval and completed at no cost to PHA.

B. Filling low areas of hardened RCC with fresh RCC is not permitted.

C. Repairs shall be started within seven days. The RCC shall be removed by saw cutting full-depth before removal. Replace the RCC utilizing Cast-in-Place concrete, which meets the requirements of Section 32 13 13.00 – Concrete Pavement of these Specifications. Reinforcement shall not be required and thickness shall be as specified for RCC. The new concrete shall be doweled into the existing RCC utilizing epoxy-coated, 1-1/2 -inch dowel bars, 20” long at 18-inches on center.

D. RCC removal and replacement:

1. Remove and replace the RCC if surface cracks, wider than 1/4 inch occur after seven days.
2. Remove and replace the RCC if deficient in thickness by more than 0.5 inches of the specified total thickness.
3. Remove and replace the RCC if the 7-day compressive strength is under 90% of specified strength as specified in "Pay Adjustments" in this Section,
4. Grind off high surface variations to a finish acceptable to the Port Authority.

E. All repairs shall be done at no cost to PHA.

3.11 CONSTRUCTION JOINT AND TRENCH JOINT

A. A fresh joint is made when an adjacent RCC lane is placed within 60 minutes of placing the previous lane. It is a joint that is vertical or less than the slope as determined by test area in 3.4.E, and will not require treatment specified for cold joints.

1. Fresh longitudinal joints shall be constructed prior to placement of an adjacent lane by leaving the outer 24-inches of base in the paving lane uncompacted during rolling.
2. Adjacent lanes shall be placed such that the new lane abuts tightly against the incomplete edge of the prior lane.
3. Joint formed by both lanes shall be compacted by centering the roller drum over the joint and compacting both edges simultaneously.
4. Extra passes of the roller may be required at the joint to achieve the required density.
B. Any planned or unplanned construction joints in the RCC that do not qualify as fresh joints shall be considered cold joint. Longitudinal, transverse or cold joints shall be treated as follows:

1. Immediately prior to placing fresh RCC mixture against the cold joint, the joint shall be prepared by first removing any loose or foreign material and then brushing on a thick layer of cement and water slurry. The slurry shall consist of one part water and two parts Portland cement by weight.

2. Uneven surfaces or slopes greater than as determined in 3.4.E shall be cut vertically for the full depth of the RCC. The edge of cold joints cut within 60 minutes of placement of the RCC material may be cut by a mechanical method approved by the Engineer. Edges of cold joints cut after 60 minutes of the placement shall be saw-cut for the full depth of the RCC.

C. The rollers shall pass over the end of the freshly placed RCC mixture when a vertical cold joint is to be made. The edge of the previously placed RCC pavement shall be cut back to expose an even vertical surface for the full thickness of the course without disturbance of the RCC that is to remain in place. Uneven areas and raveling shall be corrected by hand operations.

D. The top layer shall be placed so that longitudinal joints in that layer will coincide with joints in the lower layers of the pavement. Transverse joints in the top layer shall coincide with transverse joints in the lower layers of the pavement.

PART 4 MEASUREMENT AND PAYMENT

A. Unit Price:

1. Roller compacted concrete pavement shall be measured by the square yard of surface area of completed and accepted pavement at the thickness indicated. When detailed for the installation of “Thickened Edge”, pavement will be measured at the thickness of the adjacent thinner section of pavement.

   The quantity of roller compacted concrete pavement measured as set out above shall be paid for at the unit price bid for “Roller Compacted Concrete Pavement,” at the thickness indicated, which the price shall be full compensation for shaping and fine grading the subgrade; for furnishing and placing in the pavement; for furnishing and placing all expansion joints, sawed joints, construction joints, joint seals, other type required joints, or load bearing devices; and for all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work. No direct payment will be made for any of these items of the pavement construction. The payment for these items shall be included in the bid unit price per square yard of “Roller Compacted Concrete.” for the thickness indicated.

   Items for Payment are listed as:

   32 13 13.01-1 18” Roller Compacted Concrete Pavement – per square yard
   32 13 13.01-2 14” Roller Compacted Concrete Pavement – per square yard
   32 13 13.01-3 11” Roller Compacted Concrete Pavement – per square yard
Detailed specifications for subgrade, joints and other items of the roller compacted concrete pavement construction except the roller compacted concrete pavement specified herein are provided elsewhere in other sections of the contract specifications of which these Technical Specifications for Roller Compacted Concrete Pavement are attached to and made a part.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 13 13.02 Add - CONCRETE PAVEMENT

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes the furnishing and placing of reinforced Portland cement concrete pavement constructed on a compacted subgrade, in accordance with these specifications and in conformity with the lines, grades, thicknesses, and typical and special cross sections shown on the Drawings.

B. This Section includes payment for lean concrete, concrete filled steel bollards, and concrete wheel stops.

1.2  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.3  MEASUREMENT AND PAYMENT

A. Unit Price:

1. Subject to Section III, concrete pavement shall be measured by the Square Yard of surface area at the depth specified on the plans of completed and accepted pavement.

When the plans, specifications and proposal require the construction of a “Curb,” the limits of measurement for concrete pavement shall be from back to back of curb.

2. The quantity of concrete pavement measured as set out above shall be paid for at the unit price per Square Yard for pavement at the thickness indicated, which price shall be full compensation for shaping and fine grading the underlying course; for furnishing and placing in the pavement all reinforcing steel and ties and supports therefore; for furnishing and placing all expansion joints, sawed joints, construction joints, joint sealants, other type required joints, or load bearing devices; and for all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work. No separate payment will be made for any of these items; the payment for these items shall be included in the unit price per square yard of pavement, at the depth indicated.

3. Jointed reinforced concrete pavement (JRCP) shall be paid for at the unit price per square yard for “Jointed Reinforced Concrete Pavement” at the thickness indicated, which price shall be full compensation for shaping and fine grading the underlying pavement section; for furnishing and placing the pavement, including
reinforcement, and for all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work.

4. Jointed plain concrete pavement (JPCP) shall be paid for at the unit price per square yard for “Jointed Plain Concrete Pavement” at the thickness indicated, which price shall be full compensation for shaping and fine grading the underlying pavement section; for furnishing and placing the pavement and for all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work.

5. Lean Concrete shall be paid for at the unit price per square yard for “Lean Concrete” at the thickness indicated, which price shall be full compensation for shaping and fine grading the underlying section; for furnishing and placing the concrete and for all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work.

6. Payment for Concrete Filled Steel Bollard shall be paid for on a unit basis price per Each bollard constructed and accepted.

7. Refer to Section 10 of the General Conditions - Payment for unit price procedures.

1.4 RELATED SECTIONS

A. Reinforcing steel shall be furnished and installed in accordance with Section 03 21 00.00 - Reinforcing Steel.

B. Board expansion joints shall be furnished and placed in accordance with Section 32 13 20.00 – Concrete Joints and Embedded Items.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Contractor shall comply with standards for air quality or air emissions associated with concrete production during construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mix: The concrete shall be composed of Type I, or, if so specified on the Drawings or elsewhere in the contract specifications, Type III of a standard brand of Portland cement; coarse aggregate; fine aggregate and water; mixed and proportioned so as to produce a concrete that will have a minimum flexural strength of 500 pounds per square inch at the end of seven days, and a minimum flexural strength of 770 pounds per square inch at the end of 28 days. An air-entraining agent may be added as specified in Paragraph Air-Entraining Admixture of this specification. The concrete shall contain not less than five sacks of cement per cubic yard, with not more than 6-1/4 gallons of water, net, per sack of cement, and shall be uniform and workable. The amount of coarse aggregate (dry-loose volume) shall not be more than 0.85 cubic yard per cubic yard of concrete.

B. The concrete shall have a slump of not less than 1-1/2 inches, when tested in accordance with the Standard Slump Test of the American Society for Testing and Materials. Concrete for side-form placement with a slump of less than 1 inch or more than 4 inches shall be rejected. Concrete for slip-form placement with a slump of less than 1 inch or more than 2-1/2 inches shall be rejected.
C. The net amount of water will be the amount added at the mixer plus the free water in the aggregates, plus or minus the absorption of aggregates, based on a 30-minute absorption period. No water allowance will be made for evaporation after batching.

D. A laboratory engaged by the Contractor shall establish a concrete mix design at the Contractor’s expense. The laboratory shall make up at least two batches of concrete, and a minimum of eight standard-size beams from each batch shall be molded, properly cured and tested for the determination of 7-day and 28-day flexural strength as outlined in ASTM C78, latest revision, titled “Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).” The laboratory shall also prepare a minimum of 16 standard size cylinder specimens from each batch for determination of corresponding compressive strengths (ASTM C29) and splitting tensile strengths (ASTM C496). Test specimens shall be prepared in accordance with ASTM C31. The results of such design and test shall be reported to the Port Construction Representative.

E. If these fail to meet the required breaking strength, the mix shall be redesigned and more batches and specimens made and tested as above. This procedure shall be repeated until a satisfactory batch design has been determined. After the mix proportions and water-cement ratio required to produce the given strength have been determined, the Contractor may begin placing the concrete. The mix shall be redesigned during the job as may be necessary to obtain the specified strength, or if a change in materials, or source of materials, is desired, in the same manner as outlined for the initial design.

2.2 AGGREGATE

A. Fine and coarse aggregate shall comply with the requirements of Specifications for Concrete Aggregate, ASTM Designation C33, latest revision. Coarse aggregate shall be Size No. 467 (nominal sieve size 1-1/2” to No. 4).

B. Fine and coarse aggregate shall be tested for deleterious reactivity with alkalies in the cement, which may cause excessive expansion of the concrete. Tests of coarse and fine aggregate shall be made in accordance with ASTM C 1260. If the expansion of the coarse or fine aggregate test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 16 days from casting, the coarse or fine aggregates shall be respectively accepted. If the expansion at 16 days is greater than 0.10%, test specimens shall be produced using all components (e.g. coarse aggregate, fine aggregate, cementitious materials, and/or specific reactivity reducing chemicals) in the proportions proposed for the mixture design. If the expansion of the proposed mixture design test specimens, tested in accordance with ASTM C 1260, does not exceed 0.10 % at 16 days from casting, the aggregates will be accepted. If the expansion of the proposed mixture design test specimens is greater than 0.10% at 16 days, the aggregates must then be tested in accordance with ASTM C 1293. If the ASTM C 1293 results are satisfactory, then the aggregates are acceptable.

C. Coarse aggregate shall be washed and shall consist of durable particles of gravel, crushed stone, or a combination thereof, and shall be free of frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material either free or as an adherent coating. Coarse aggregate shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale, nor more than 5.0 percent by weight of laminated and/or friable particles when tested in accordance with Texas Test Method TEX-413A. The combined percent of all such materials shall not exceed 5.0 percent. Coarse aggregate from each source shall have a wear of not more than 40 percent when tested in accordance with Texas Test Method Tex-410-A. Coarse aggregate shall have a maximum loss of 12 percent and 18 percent respectively when
subject to five cycles of the sodium sulphate and magnesium sulphate soundness test in accordance with Texas Test Method Tex-411-A.

D. Fine aggregate shall be washed and consist of clean, hard, durable and uncoated particles of natural siliceous sand. It shall be free of frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material, and it shall contain not more than 0.5 percent by weight of clay lumps. The sand equivalent shall not be less than 80 when tested in accordance with Texas Test Method Tex-203-F, and a fineness modulus between 2.3 and 3.1 as determined by Texas Test Method Tex-402-A the acid insoluble residue of the fine aggregate shall not be less than 60 percent by weight when tested in accordance with Texas Test Method Tex-612-J.

2.3 CEMENT

A. Portland cement shall be sampled and tested in accordance with, and shall meet the requirements prescribed by, the ASTM Specifications, Designation C150, titled “Portland Cement,” latest revision. Cement manufacturer shall be approved by TxDOT.

B. Total Alkalies (Na2O & K2O) of the cement shall be verified in accordance with ASTM C 114. Total Equivalent alkalies shall be less than 0.6%.

C. Cement in bulk meeting the above requirements may be used, provided the method of handling is approved by the Port Construction Representative. Weighing devices satisfactory to the Port Construction Representative shall be provided by the Contractor.

2.4 MIXING WATER

A. Water for use in the mixing of Portland cement concrete shall be clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

B. When comparative tests are made with water of known satisfactory quality, any indication of unsoundness, marked change in time of set, or reduction of more than 10 percent in mortar strength shall be sufficient cause for the rejection of the water under test. Water from doubtful sources shall not be used until tested and approved.

C. Water which is suitable for drinking or for ordinary household use may be accepted for use without being tested.

2.5 AIR-ENTRAINING ADMIXTURE

A. An air-entraining admixture may be used, at the option of the Contractor, in the mixing water prior to its introduction into the concrete mix. The air-entraining admixture used shall be in accordance with ASTM Specifications, Designation C260, entitled “Air-Entraining Admixtures for Concrete.” The admixture shall be added to the mixing water through an automatic dispenser which will accurately control the amount used. The amount of admixture used shall produce the entrainment of 4 to 6 percent of air by volume of concrete.
PART 3       EXECUTION

3.1       PREPARATION

A. Measuring Materials: All materials shall be separately and accurately measure by weight, using standard weighing devices attached to a standard batching plant approved by the Port Construction Representative. A sack of cement as packed by the manufacturer and weighing 94 pounds shall be considered one cubic foot.

B. Scales shall be of the beam type or of the springless dial type. The beam type shall be equipped with a springless dial indicator showing at least 100 pounds over or under the required weight. All scales or dial indicators shall be graduated in increments of five pounds or less.

C. Scales not accurate to within a tolerance of four pounds per 1,000 pounds of net load in the hopper shall not be used.

3.2       CONSTRUCTION METHODS

A. The Contractor has the option of placing the concrete with either side (fixed) forms or slip-forms. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet (1 m). Backhoes and Grading equipment shall not be used to distribute the concrete in front of the paver.

B. Concrete Strength Tests:

1. While concrete paving work progresses, standard beam and cylinder specimens of such dimensions and numbers as may be required by the Port Construction Representative shall be provided by the Contractor to the testing laboratory each day. These beams and cylinders shall be cured continuously in water until tested by the testing laboratory. These tests will be paid for by the Port of Houston Authority. Test results lower than the specified flexural strength and corresponding splitting tensile strength shall be grounds for rejection.

2. The concrete pavement will be core drilled in order to determine the thickness of said pavement. Cores shall comply with ASTM C42 and shall be 4-inch diameter. There will be one core taken for each 500 square yards of pavement. These tests will be paid for by the Port of Houston Authority; however, the cost of backfilling core holes with a suitable grout shall be paid for by the Contractor. In the event the pavement is revealed to be 3/8 inch more or less than the specified thickness, such pavement shall be removed and replaced with concrete pavement of the specified thickness at the sole expense of the Contractor.

C. Mixing:

1. The mixing of concrete shall be done in a batch mixer in a manner that will ensure a uniform distribution of the materials throughout the mix. The mixture shall be uniform in color and homogeneous.

2. The mixer shall be equipped with suitable charging hopper, water storage, and water measuring device controlled from a case which can be kept locked, and shall be so constructed that the water can be discharged only while the mixer is being charged. It also shall be equipped with an attachment for automatically locking the discharge lever until the batch has been mixed the required time after all materials are in the mixer.
3. All water valves must be kept tight to prevent leakage.
4. The mixer shall be cleaned after each day’s run.
5. The volume of the mixed material per batch shall not exceed the manufacturer’s rated capacity of the mixer. Ready-mixed concrete meeting these specifications may be used.
6. Discharge of the concrete into the forms shall be completed within sixty minutes after the introduction of the mixing water into the cement and aggregates or the introduction of the cement to the aggregates.

D. Time of Mixing: The mixing of each batch shall continue for not less than one minute after all the material is in the mixer, or longer if necessary, in the judgment of the Port Construction Representative, to attain a uniform color, during which time the mixer drum shall rotate at a speed of fourteen to twenty revolutions per minute.

E. Forms:

1. Side forms shall be standard metal pavement forms, except that wooden forms may be used on curves, and shall be of a section satisfactory to the Port Construction Representative, free from warp, and of a depth not less than the thickness of the finished work. The forms shall be securely staked to line and grade and maintained in a true position during the depositing of concrete.
2. The length of the form sections shall be not less than ten feet, and each section shall provide for staking in position with not less than three pins. Forms shall be of ample strength and shall be provided with adequate devices for securing setting so that when in place they will withstand, without visible springing or settlement, the impact and vibration of the finishing equipment. The base width of the form shall be equal to or greater than the height except when smaller base width dimensions are approved by the Port Construction Representative. The forms shall be free from warps, bends, or kinks, and shall be sufficiently true to provide a reasonably straight edge on the concrete, and the top of each form section, when tested with a straight edge, shall conform to the requirements specified for the surface of the completed pavement. Sufficient forms shall be provided for satisfactory prosecution of the work.
3. Contractor may submit alternate methods using slip forms to Port Construction Representative for consideration.

F. Placing and Removing Forms:

1. The subgrade under the forms shall be firm and cut true to grade so that each form section, when placed, will be firmly in contact for its whole length and base width, and exactly at the established grade. Any subgrade under the forms below established grade shall be corrected, using suitable material, placed, sprinkled and compacted as directed. Forms shall be staked with at least three pins for each ten-foot section. A pin shall be placed at each side of every joint. Form sections shall be tightly joined and keyed to prevent relative displacement. Forms shall be cleaned and oiled each time they are used. Sufficient stability of forms to support the equipment operated thereon and to withstand its vibration without springing or settlement shall be required. If forms settle over 1/8 inch under finishing operations, paving operations shall be stopped and the forms shall be reset to line and grade.
2. Whenever possible, side forms shall be oriented parallel to the surface fall of the pavement.
3. Forms shall remain in place for not less than eight hours after the concrete has been placed. They shall be carefully removed in such a manner that little or no
damage will be done to the edge of the pavement. Any damage resulting from this operation shall be immediately repaired. After the forms have been removed, the ends of all joints shall be cleaned and any honeycombed areas pointed up with approved mortar.

G. Slip-Form Paving:

1. When slip-form pavement is utilized, the concrete shall be distributed uniformly into final position by a self propelled paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms.

2. The plastic concrete shall be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit shall not exceed 9 inches. The spacing of internal units shall be uniform and shall not exceed 18 inches.

3. The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible. And all operations of mixing, delivering, and spreading concrete shall be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

4. When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

H. Construction Joint: When it becomes necessary to stop concreting for a period of over thirty minutes, a bulkhead or construction header made square, plumb and true to line shall be installed and concrete spaded well against the bulkhead so that a minimum of honeycombing will appear upon the removal of the forms.

I. Preparation: Thoroughly moisten the underlying base layers prior to depositing concrete. Ensure that sufficient water is used to penetrate the aggregate base course by at least 1 inch.

J. Depositing Concrete:

1. Before depositing concrete, hardened concrete and foreign material shall be removed from the space to be occupied by the concrete, and the prepared base course shall be sprinkled.

2. Forms shall be set, and grade checked for a distance of not less than 250 feet ahead of the mixer, unless otherwise ordered by the Port Construction Representative.
K. Handling:

1. Concrete shall be handled from the mixer to the place of final deposit as practical and in a manner that will prevent the segregation of the ingredients. It shall be deposited in the forms and on the completed base course so as to maintain a plastic surface conforming to the standard section until the completion of the unit. Raking of the concrete will not be allowed.

2. In no case shall concrete that has partly hardened be deposited in the work nor shall water be added to concrete after it leaves the mixer.

L. Compacting and Finishing:

1. All concrete shall be consolidated by vibration, spading, rodding and forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone packets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 8,000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. They shall be operated by competent workmen. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 inches apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation, generally from 5 to 15 seconds. A spare vibrator shall be kept on the jobsite during all concrete placing operations.

2. The concrete shall be struck off with an approved finishing machine strike-off screed to such elevation that when consolidated and finished the surface of the pavement shall conform to the required section and grade. The finishing machine strike-off template shall be moved forward with a combined transverse and longitudinal motion in the direction the work is progressing, maintaining the template in contact with the forms, and maintaining a slight excess of material in front of the cutting edge. The concrete shall then be tamped with an approved tamping template to compact the concrete thoroughly and eliminate surface voids, and the surface screeded to required section.

3. After completion of the strike-off, consolidation, and transverse screeding, a hand operated longitudinal float shall be operated to test and level the surface to the required grade.

4. Just before the concrete becomes non-plastic, the surface shall be belted with an approved belt, operated with short transverse strokes and rapid advance longitudinally. This operation shall produce a uniform surface with a gritty texture.

M. Temperature Conditions: No concrete shall be mixed until the air temperature is at least 45 degrees F. and rising. No materials containing frost or lumps of hardened materials shall be used. In hot weather the aggregates, cement mixing water and jobsite shall be kept cool as possible and admixtures shall be used to prevent premature initial set. Ice shall be used for part of the mixing water if necessary.

N. Saw Cutting Joints: Saw cut joints shall be formed in a two stage operation. The first stage shall be a one saw blade width to the depth shown on the Drawings. Sawing shall commence as soon as the concrete has reached its final set as determined in accordance with ASTM C403. The Contractor shall provide sufficient number of saws and cut all joints in one continuous operation, and shall have sufficient saws and new blades on site on standby in case of breakdown. The saw shall produce a cut that does not ravel the concrete by more than 1/8 inches from the face of the saw cut. The second stage shall not be performed earlier than 72 hours after concrete is placed and shall be...
performed to form the joint as indicated in the Plans. Protect saw cuts from damage and entry of objectionable material until joint sealant is placed. Misaligned saw cuts shall be corrected by partial depth patching to the full depth of the saw cut.

O. Surface Tests:

1. Before the initial set, the entire surface shall be tested and all irregularities or undulations not within the tolerance of the following test shall be corrected and brought within the requirements of the test, and the surface finished as necessary.
2. An approved 10-foot long straightedge shall be placed both perpendicular and parallel to the direction of the surface fall so as to bridge any depressions and touch all high spots. Ordinates measured from the face of the straightedge to the surface of the pavement shall at no place exceed 1/16 inch per foot from the nearest point of contact, and in no case shall the maximum ordinate to a 20-foot straightedge be greater than 1/4 inch. Any surface not within tolerance limits shall be reworked and refinished.

P. Protection and Curing:

1. The concrete shall be covered with burlap or suitable cotton mats shall be kept wet continuously for a period of 72 hours after the placing of the burlaps or mats, and the curing shall commence as soon as the concrete has hardened sufficiently to be unmarked by the method of curing. In lieu of the above, curing compound approved by the Port Construction Representative and applied according to manufacturer’s directions may be used. Prior approval of the compound, its color and the method of application must be secured from the Port Construction Representative before placing any concrete. Any curing compound used must provide not less than 85% water retention (when tested in accordance with ASTM Standard Method C156) and must not permanently discolor the concrete.
2. Barricade a pavement section from use for at least 72 hours during the curing period. Do not open pavement to traffic until concrete is at least 10 days old. On those sections of pavement open to traffic, seal the joints, clean the pavement and place earth against the pavement edges before permitting use by traffic. Such opening of pavement to traffic in no way relieves the Contractor from his responsibility for the work.

Q. Correction of Deficiencies: Remove and replace full concrete slabs in a manner approved by the Port Construction Representative, and at no cost to the Port Authority if the concrete fails to achieve the specified strength, fails to meet the specified thickness or if the slabs exhibit cracks prior to delivery to the Port of Houston Authority. Diamond grinding may be used to overcome high points with the approval of the Port Construction Representative.

1. Pavement within 1/4-inch of the designated thickness will be considered of satisfactory thickness. Payment will be made at the unit price per square yard.
2. Pavement which is between 1/4-inch and 1/2-inch less than the designated thickness will be considered as deficient thickness and will be paid for at an adjusted unit price. The adjusted unit price will bear the same ratio to the contract unit price as the square of the actual average thickness bears to the square of the designated thickness. The length of the area of deficient thickness will be as determined from additional cores. The width of the area will be the entire width of the pavement within the length thus determined.
3. Pavement which is between 1/2-inch and 3/4-inch less than the designated thickness will be considered as unsatisfactory thickness. No payment will be made for pavement of unsatisfactory thickness. The area of unsatisfactory thickness will be determined by the same method as used to determine the area of deficient thickness. The pavement may be left in place if the Contractor relinquishes any claim for compensation for the area with unsatisfactory thickness. The Contractor may choose to remove the pavement and replace it with pavement of the designated thickness for which payment will be made as specified. No reimbursement will be granted for removing pavement of unsatisfactory thickness.

4. Pavement which is not within 3/4-inch of the designated thickness is considered as unacceptable thickness. No payment will be made for pavement with unacceptable thickness. The area of unacceptable thickness will be determined as the same method as used to determine the area of deficient thickness. Pavement of unacceptable thickness may not be left in place; remove and replace it with pavement of the designated thickness for which payment will be made as specified. No reimbursement will be granted for removing pavement of unacceptable thickness.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 13 14.00 Add - MISCELLANEOUS CONCRETE CONSTRUCTION

PART 1    GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes the furnishing of all labor, material, tools, equipment, and the performance of all operations required to complete all concrete work indicated on the Drawings and herein specified.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Contractor shall submit mill certificates for bulk cement.

C. Design Mixes:

1. Submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ratio; compressive strength test results for 7 and 28 days; and shrinkage tests for Class C and D concrete at 21 or 28 days of drying.

2. Submit abrasion loss and soundness test results for limestone aggregate.

3. Testing of aggregates, including sieve analysis, shall be performed by a certified independent testing laboratory. Tests shall have been performed no earlier than 3 months before Purchase Order Date.

4. Provide standard deviation data for plant producing concrete. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 318, Item 5.3.1. Laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 318, Table 5.3.2.2.

5. Review and acceptance of mix design does not relieve Contractor of responsibility to provide concrete of quality and strength required by these Specifications.

D. Admixtures: Submit manufacturer's technical information, including following:

1. Air-Entraining Admixture: Give requirements to control air content under all conditions, including temperature variations and presence of other admixtures.

2. Chemical Admixtures: Give requirements for quantities and types to be used under various temperatures and job conditions to produce uniform, workable concrete mix. Submit evidence of compatibility with other admixtures and cementitious materials proposed for use in design mix.
E. High-range Water Reducer (Superplasticizer): When proposed for use, submit manufacturer's technical information and instructions for use of superplasticizer. State whether superplasticizer will be added at ready-mix plant or job site. When superplasticizer will be added at job site, submit proposed plan for measuring and adding superplasticizer to concrete mix at job site, and establish dosing area on site with holding tanks and metering devices. When superplasticizer is to be added at ready-mix plant, submit contingency plans for adding additional superplasticizer at job site when required due to delay in placing concrete. Identify portions of Work on which superplasticizer is proposed for use.

F. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and cold weather concreting. Review and acceptance of proposed procedure will not relieve Contractor of responsibility for quality of finished product.

G. Project Record Drawings: Accurately record actual locations of embedded utilities and components which are concealed from view.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, there will be no separate payment for miscellaneous concrete construction under this Section. Include payment in unit price of items for which Miscellaneous Concrete Construction is a component.

1.4 REFERENCES

A. All concrete construction shall be in accordance with the latest edition of the ACI Manual of Concrete Practice, Parts 1 through 3, unless specifically noted otherwise in these Specifications and the other Contract Documents.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Contractor shall comply with standards for air quality or air emissions associated with concrete production during construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: Portland cement shall conform to the requirements of ASTM C150, for either Type I or Type II cement.

B. Aggregate: Fine and coarse aggregate shall comply with ASTM Designation C33.

C. Water: Mixing water for concrete shall be fresh, clean and potable. The Contractor is responsible for supplying water for construction in accordance with Section 01 50 00.00 - Temporary Facilities and Controls.
D. Admixtures:

1. Air Entrainment: An approved brand of air entraining agent conforming to "Specifications for Air-Entraining Admixtures for Concrete," ASTM C260 shall be used with all concrete. It shall be introduced in the mixture at the mixer in such quantities as to provide not more than five percent nor less than three percent entrained air as determined by tests performed in accordance with ASTM C138. Entrained air in concrete floor slabs shall not exceed 4.5 percent.

2. Water-Reducing, Retarding and Accelerating Admixtures:
   a. Water-reducing, retarding and accelerating admixtures shall conform to the requirements of "Specifications for Chemical Admixtures for Concrete," ASTM C494. Acceptable manufacturers are:
      1) W. R. Grace and Co.
      2) Master Builders Co.
      3) Sika Chemical Co.
      4) Gifford-Hill & Co., Inc.
      5) Fox Industries, Inc.
   b. Products of other manufacturers may be submitted for approval. No admixture containing calcium chloride may be used at any time.
   c. The manufacturer shall submit a statement of conformance to ASTM C494, including test results.

3. Use of Admixtures:
   a. Water-reducing admixtures may be added to improve workability or reduce the amount of water required for hydration.
   b. All concrete placed in slabs when the ambient temperature is 85 degrees F., or higher, shall contain a set-retarding admixture.
   c. Amounts of admixtures to be added to the mix shall be in accordance with the manufacturer's instructions to achieve the desired results.

E. Concrete Strength: The strength of concrete shall be 4,000 psi in 28 days (3,000 psi in 7 days) with aggregate size No. 467 (1-1/2" to No. 4).

F. Storage of Materials: Storage of materials shall conform to ACI 301, Section 2.5.

2.2 FORM MATERIALS

A. General:

1. Forms shall conform to the requirements of ACI 301, Chapter 4.
2. Form materials shall be of wood, metal, fiberglass, or other material approved by the Port Construction Representative. Wherever rubbed surfaces are indicated on the Drawings or hereinafter specified, the forms shall be lined, plywood, or approved metal forms. Forms shall conform to the following requirements:
   a. Unlined Wood Forms: Lumber used in forms or exposed surfaces shall be dressed to a uniform thickness, and shall be free from loose knots, splits, or other defects. Undressed lumber may be used for unexposed surfaces. Joints in forms shall be horizontal or vertical.
   b. Lined Forms: Lining material shall be moisture resistant concrete-form plywood, form grade hardboard, metal, plastic, or other approved material.
   c. Universal Standard Plywood Form Panels: Panels shall be designed to produce and maintain shape, lines and dimensions of the concrete as called for on the Drawings.
d. Metal Forms: Metal forms shall be an approved type that will produce surfaces equal to those produced by specified wood forms. Headers, bridging, appurtenances, or special metal forms in accordance with requirements peculiar to the design of the forms shall be provided and installed where required.

e. Plywood Forms: Plywood shall be moisture resistant concrete-form plywood at least 9/16-inch in thickness, and not less than 5-ply.

B. Chamfer Strips: Chamfer strips shall be placed in the corners of forms to produce a 3/4" bevel or radius on all exterior corners.

C. Form Ties: Bolts and rods or rigid metal form ties of an approved type which are especially designed for use in connection with concrete work shall be used for temporary internal ties. They shall be coated with grease and so arranged that when the forms are removed no metal will be within one inch of any concrete surface. Wire ties will be permitted only for minor or special form areas where the use of rigid type metal ties would be impracticable. Wire ties will not be permitted where the concrete surface will be exposed to weathering, or at any point where discoloration will be objectionable.

PART 3 EXECUTION

3.1 PREPARATION OF FORM SURFACES

A. Preparation of form surfaces shall conform to ACI 301, Section 4.4.

B. Tolerances: Tolerances for formed surfaces shall meet the requirements of ACI-301, Table 4.3.1.

C. Proportioning of Concrete:

1. Proportioning of concrete shall conform to ACI 301, Chapter 3.

2. The concrete shall be composed of Portland cement, coarse aggregate, fine aggregate, approved admixtures and water. Concrete shall meet all requirements herein for strength, cement content, water-cement ratio, slump, etc.

3. Proportions shall be established by the Contractor and submitted to the Port Construction Representative for verification by a testing laboratory selected by the Port of Houston Authority. Proportions may be established on the basis of ACI 301, Section 3.8.2.

4. Water-cement ratio shall be determined by strength requirements, except that minimum cement content shall be five (5) sacks per cubic yard.

5. Unless indicated otherwise on the Drawings, the maximum slump shall be four inches (4"). Higher slumps may be approved by the Port Construction Representative if achieved without detrimental effects to the concrete.

3.2 REMOVAL OF FORMS AND FALSEWORK

A. General: Forms and falsework shall not be removed without the approval of the Port Construction Representative. The removal of forms and falsework shall be accomplished in such a manner as to prevent injury to the concrete.

B. Removal Strength: When removal of formwork or reshoring is based on the concrete reaching a specified strength, the concrete shall be presumed to have reached this strength only when test cylinders, field cured along with the concrete they represent,
have reached the strength specified for removal of formwork. The costs of testing shall be borne by the Port of Houston Authority; however, the Contractor is responsible for making and providing the cylinders to the testing laboratory.

3.3 PRODUCTION OF CONCRETE

A. Ready-Mix Concrete:

1. Except as otherwise provided in these Specifications ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C94. Plant equipment and facilities shall conform to the "Check List for Certification of Ready Mixed Concrete Production Facilities" of the National Ready Mixed Concrete Association.

2. Discharge of the concrete shall be completed within sixty minutes after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregate.

B. Placing: The placing of concrete shall conform to ACI 301, Chapter 8.

C. Repair of Surface Defects: Repair of surface defects shall conform to ACI 301, Chapter 9.

D. Finishing of Concrete Surfaces:

1. Rough form finish for surfaces under wharves.

2. Broom or belt finish for wharf deck slab and other exterior slab surfaces.

E. Description of Finishes:

1. Rough Form Finish: No form facing materials are required for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4 in. in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.

2. Floated Finish: After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. During or after the first floating, planeness of surface shall be checked with a 10-ft. straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a surface within Class B tolerance throughout. The slab shall then be refloated immediately to a uniform sandy texture.

3. Broom or Belt Finish: Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

4. Curing and Protection: Curing and protection shall conform to ACI 301, Chapter 12.

3.4 QUALITY ASSURANCE

A. Provide necessary controls during evaluation of materials, mix designs, production and delivery of concrete, placement and compaction to assure that the Work will be accomplished in accordance with Contract Documents. Maintain records of concrete placement. Record dates, locations, quantities, air temperatures, and test samples taken.
B. Concrete construction for buildings shall conform to ACI 318.

3.5 SAMPLING AND TESTING FOR CONCRETE

A. Concrete testing required in this section will be performed by an independent commercial testing laboratory employed and paid by the Port of Houston Authority, except as set out herein, in accordance with Material Testing in the General Conditions. Tests to be made at the Port of Houston Authority’s expense shall be ordered by the Port Construction Representative only, and not by the Contractor.

B. Standard Services: The testing agency will perform the following services:

1. Verification that plant equipment and facilities conform to NRMCA "Certification of Ready-Mix Concrete Production Facilities".
2. Testing of proposed materials for compliance with this Specification.
3. Review of proposed mix design submitted by Contractor.
4. Obtaining production samples of materials at plants or stockpiles during work progress and testing for compliance with this Specification.
5. Strength testing of concrete according to following procedures:
   a. Obtaining samples for field test cylinders from every 100 cubic yards and any portion less than 100 cubic yards for each mix design placed each day, according to ASTM C 172, with each sample obtained from a different batch of concrete on a representative, random basis. Selecting test batches by any means other than random numbers chosen before concrete placement begins is not allowed.
   b. Molding four specimens from each sample according to ASTM C 31, and curing under standard moisture and temperature conditions as specified in Sections 7(a) and (b) of ASTM C 31.
   c. Testing two specimens at 7 days and two specimens at 28 days according to ASTM C 39, reporting test results averaging strengths of two specimens. However, when one specimen evidences improper sampling, molding or testing, it will be discarded and remaining cylinder considered test result. When high-early-strength concrete is used, specimens will be tested at 3 and 7 days.
6. Air content: For each strength test, determination of air content of normal weight concrete according to ASTM C 231.
7. Slump: For each strength test, and whenever consistency of concrete appears to vary, conducting slump test in accordance with ASTM C 143.
8. Temperature: For each strength test, checking concrete temperature in accordance with ASTM C 1064.
9. Lightweight concrete: For each strength test, or more frequently when requested by Port Construction Representative, determination of air content by ASTM C 567 and unit weight by ASTM C 567.
10. Monitoring of current and forecasted climatic conditions to determine when rate of evaporation, as determined by Figure 2.1.5 of ACI 305R, will produce loss of 0.2 pounds of water, or more, per square foot per hour. Testing lab representative will advise Contractor to use hot weather precautions when such conditions will exist during concrete placement, and note on concrete test reports when Contractor has been advised that hot weather conditions will exist.
11. Class A and D Concrete Shrinkage Tests: Performance of drying shrinkage tests for trial batches as follows:
   a. Preparation and Testing of Specimens: Compression and drying shrinkage test specimens will be taken in each case from the same concrete sample; shrinkage tests will be considered a part of the normal
compression tests for the project. 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157, modified as follows:

1) Wet curing: Remove specimens from molds at an age of 23 hours, 1 hour after trial batching and immediately immerse in water at 70 degrees F, 3 degrees F for at least 30 minutes;
2) Measure within 30 minutes after first 30 minutes of immersion to determine original length (not to be confused with "base length");
3) Then submerge in saturated limewater, at 73 degrees F, 3 degrees F, for 7 days;
4) Then measure at age 7 days to establish "base length" for drying shrinkage calculations ("zero" days drying age);
5) Calculate expansion (base length expressed as a percentage of original length);
6) Immediately store specimens in a temperature- and humidity-controlled room maintained at 73 degrees F, ±3 degrees F and 50 percent ±4 percent relative humidity, for the remainder of the test.
7) Measure to determine shrinkage, expressed as percentage of base length. Compute the drying shrinkage deformation of each specimen as the difference between the base length (at ?zero@ days drying age) and the length after drying at each test age. Compute the average drying shrinkage deformation of the specimens to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, disregard the results obtained from that specimen. Report results of shrinkage tests to the nearest 0.001 percent of shrinkage.
8) Report shrinkage separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

C. Additional Testing and Quality Control Services: The following will be performed by an independent commercial testing laboratory employed and paid by the Port of Houston Authority when requested by Port Construction Representative.

1. Checking of batching and mixing operations.
2. Review of manufacturer's report of each cement shipment and conducting laboratory tests of cement.
3. Molding and testing reserve 7-day cylinders or field cylinders.
4. Conducting additional field tests for slump, concrete temperature and ambient temperature.
D. Authority of the Testing Agency: Representatives of the agency shall inspect, sample and test the materials and monitor the production of concrete as required by the Port Construction Representative. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing agency shall report such deficiency to the Port Construction Representative and the Contractor. The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the contract documents, nor to approve or accept any part of the work.

E. Contractor's Responsibility:

1. It shall be the responsibility of the Contractor to furnish materials and construction in full compliance with the contract documents. As specified previously, he shall submit mix design and representative samples for approval.
2. To facilitate testing and inspection, the Contractor shall furnish any necessary labor to assist the designated testing agency in obtaining and handling samples at the project or other sources of materials. He shall cooperate fully with the laboratory and the Port Construction Representative and shall correct or replace any defective work.
3. The Contractor shall employ an independent commercial testing laboratory, acceptable to the Port of Houston Authority, and shall pay the costs of laboratory services required to establish mix designs for Portland cement concrete. The Contractor shall pay for the costs of analyzing aggregates, fixing gradations, preparing and testing of design cylinders or specimens and other such services required to establish mix design, or to redesign any mix when required due to any change in source of materials or other conditions.
4. The Contractor shall notify the commercial testing laboratory employed by the Port of Houston Authority 24 hours prior to placing concrete to allow for completion of quality tests and for the assignment of personnel.

F. Testing of Deficient Concrete in Place:

1. When averages of three consecutive strength test results fail to equal or exceed specified strength, or when any individual strength test result falls below specified strength by more than 500 psi, strength of concrete shall be considered potentially deficient and core testing, structural analysis or load testing may be required by the Port Construction Representative.
2. When concrete in place proves to be deficient, Contractor shall pay costs, including costs due to delays, incurred in providing additional testing and analysis services provided by the Port Construction Representative, or the independent commercial testing laboratory selected by the Port of Houston Authority.
3. Replace concrete work judged inadequate by core tests, structural analysis or load tests at no additional cost to the Port of Houston Authority.
4. Core Tests:
   a. Obtain and test cores in accordance with ASTM C 42. Where concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before test; test dry. Where concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning in accordance with ASTM C 42.
b. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Location of cores shall be determined by the Port Construction Representative so as to least impair strength of structure. When, before testing, one or more cores shows evidence of having been damaged during or after removal from structure, replace the damaged cores.

c. Concrete in area represented by core test will be considered adequate when average strength of cores is equal to at least 85 percent of specified strength, and when no single core is less than 75 percent of specified strength.

d. Patch core holes in accordance with the guidelines of this specification.

5. Structural Analysis: When core tests are inconclusive or impractical to obtain, the Port Construction Representative may perform additional structural analysis at Contractor's expense to confirm safety of structure.

6. Load Tests: When core tests and structural analysis do not confirm safety of structure, load tests may be required, and their results evaluated, in accordance with ACI 318.

7. Testing by impact hammer, sonoscope, probe penetration tests (Windsor probe), or other nondestructive device may be permitted by the Port Construction Representative to determine relative strengths at various locations in structure, to evaluate concrete strength in place, or for selecting areas to be cored. However, such tests, unless properly calibrated and correlated with other test data, shall not be used as basis for acceptance or rejection of structure's safety.
PART 1  GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit proposed mix design and test data, prepared by a certified testing laboratory employed and paid by the Contractor, for each type and strength of concrete in the Work.

C. Submit laboratory reports prepared by an independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by the Port Construction Representative.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment will be made for concrete for utility construction under this Section. Include payment in unit price of items for which concrete for utility construction is a component.

B. Obtain the services of and pay for a certified testing laboratory to prepare design mixes.

1.4 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
E. ACI 308 - Standard Practice for Curing Concrete.
F. ACI 309R - Guide for Consolidation of Concrete.
G. ACI 311 - Batch Plant Inspection and Field Testing of Ready Mixed Concrete.
I. ACI 318 - Building Code Requirements for Reinforced Concrete.
K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
N. ASTM A 767 - Standard Specifications for Zinc-coated (Galvanized) Bars for Concrete Reinforcement.
P. ASTM A 820 - Steel Fibers for Fiber Reinforced Concrete.
R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
U. ASTM C 42 - Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.
1.5 HANDLING AND STORAGE

A. Cement: Store cement off of the ground in a well-ventilated, weatherproof building.
B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to the coating.

**PART 2  PRODUCTS**

**2.1 CONCRETE MATERIALS**

A. Cementitious Material:

1. Portland Cement: ASTM C 150, Type II, unless the use of Type III is authorized by the Port Construction Representative; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.

2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in the form of $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:

1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use the following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of the narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.


3. Determine the potential reactivity of fine and coarse aggregate in accordance with the Appendix to ASTM C 33.


E. Chemical Admixtures:

1. Water Reducers: ASTM C 494, Type A.

2. Water Reducing Retarders: ASTM 494, Type D.

3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply the gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.
3. Wire: ASTM A 82. Use 16-1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Fiber:

1. Fibrillated Polypropylene Fiber:
   a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
   b. Physical Properties:
      1) Material: Polypropylene.
      2) Length: 1/2 inch or graded.
      3) Specific Gravity: 0.9l.
   c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved substitution.

2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.
   a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
   b. Physical Properties
      1) Material: Steel.
      2) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1.
      3) Specific Gravity: 7.8.
      4) Tensile Strength: 40-400 ksi.
      5) Young's Modulus: 29,000 ksi.
      6) Minimum Average Tensile Strength: 50,000 psi.
      7) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to an angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking.

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.2 FORMWORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair the finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2-inch (nominal) lumber, or 3/4-inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Formwork for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4-inch minimum thickness, preferably oiled at the mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in a gauge and condition capable of supporting concrete and construction loads without significant distortion.
Countersink bolt and rivet heads on facing sides. Use only metal forms which present a smooth surface and which line up properly.

2.3 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.4 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.5 DESIGN MIX

A. Use design mixes prepared by a certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to the Port Construction Representative for review.

C. Proportioning on the basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, if approved by the Port Construction Representative.

D. Classification:

<table>
<thead>
<tr>
<th>CLASS</th>
<th>TYPE</th>
<th>MINIMUM COMPRESSIVE STRENGTH (LBS/SQ. IN.)</th>
<th>MAXIMUM W/C RATIO</th>
<th>AIR CONTENT (PERCENT)</th>
<th>CONSISTENCY RANGE IN SLUMP (INCHES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Structural</td>
<td>3200</td>
<td>4000</td>
<td>0.45</td>
<td>4+ 1</td>
</tr>
<tr>
<td>B</td>
<td>Pipe Block Fill, Thrust Block</td>
<td>—</td>
<td>1500</td>
<td>—</td>
<td>4+ 1</td>
</tr>
</tbody>
</table>

*When ASTM C 494, Type F or Type G admixture is used to increase workability, this range may be 6 to 9.

E. Add steel or polypropylene fibers only when called for on the Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on the Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, and concrete fill unless indicated otherwise. Use Class A for all other applications.
2.6 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that the material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:
   1. Thickness: not less than 3/8 inch
   2. Acceptable Manufacturers:
      a. Kirkhill Rubber Co., Brea, California
      d. Greenstreak Plastic Products Co., St. Louis, Missouri
      e. Approved substitution.

2.7 RESILIENT WATERSTOP

A. Resilient Waterstop: Where shown on the Drawings; either a bentonite- or adhesive-type material.

B. Bentonite Waterstop:
   1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
   2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
   4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C. Adhesive Waterstop:
   1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
   2. Meets or exceeds requirements of Federal Specification SS-S-210A.
   3. Supplied wrapped completely by a 2-part protective paper.
   4. Submit independent laboratory tests verifying that the material seals joints in concrete against leakage when subjected to a minimum of 30 psi water pressure for at least 72 hours.
   5. Provide primer, to be used on hardened concrete surfaces, from the same manufacturer who supplies the waterstop material.
   6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved substitution.
PART 3  EXECUTION

3.1 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within the tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate cleanout openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back formwork with a sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer the liner on the job before using. Facing may be constructed of 3/4-inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4-inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Port Construction Representative, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before the concrete is placed, wet surface of forms which will come in contact with concrete.

3.2 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by the Port Construction Representative and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2-1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on the Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.
C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of the Port Construction Representative. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

### 3.3 EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

### 3.4 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using an automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of the Port Construction Representative before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to the site shall be accompanied by batch tickets providing the information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing the information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in the shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until the concrete has cured for a minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by the Port Construction Representative.

### 3.5 PLACING CONCRETE

A. Give sufficient advance notice to the Port Construction Representative (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel,
embedded items and other preparations for placing concrete. Place no concrete prior to the Port Construction Representative's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, if necessary to continue after daylight hours, light the site as required. If rainfall occurs after placing operations are started, provide covering to protect the work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken an initial set; do not place any strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for the size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move the vibrator vertically through the layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.6 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

C. Splicing PVC Waterstops:

1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.

2. Butt end-to-end joints of two identical waterstop sections may be made in the forms during placement of waterstop material.
3. Prior to placement in formwork, prefabricate waterstop joints involving more than two ends to be joined together, an angle cut, an alignment change, or the joining of two dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval by the Port Construction Representative, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24-inch strips to the straight-run portions of waterstop in the forms.

D. Setting PVC Waterstops:

1. Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in concrete and to prevent folding over of the waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.

2. Where a waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying to the Specifications.

F. Resilient Waterstop:

1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.

2. When requested by the Port Construction Representative, provide technical assistance by manufacturer's representative in the field at no additional cost to the Port of Houston Authority.

3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form a smooth joining surface.

5. At the free top of walls without connecting slabs, stop the resilient waterstop and grooves (where used) 6 inches from the top in vertical wall joints.

6. Bentonite Waterstop:
   a. Locate bentonite waterstop as near as possible to the center of the joint and extend continuous around the entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.

   b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1-1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.

   c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm the material or its properties. Do not install
waterstop where air temperature falls outside manufacturer's recommended range.

d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth if necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using an epoxy grout which completely fills voids and irregularities beneath the waterstop material. Prior to installation, wire brush the concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

e. In addition to the adhesive backing provided with the waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-inch maximum spacing.

7. Adhesive Waterstop:
   a. With a wire brush thoroughly clean the concrete surface on which the waterstop is to be placed and then coat with primer.
   b. If the surface is too rough to allow the waterstop to form a complete contact, grind to form an adequately smooth surface.
   c. Install the waterstop with the top protective paper left in place. Overlap joints between strips a minimum of 1 inch and cover back over with protective paper.
   d. Do not remove protective paper until just before final formwork completion. Concrete shall be placed immediately. The time that the waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.7 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Port Construction Representative. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.

3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.8 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for a period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from the concrete surface after placing and finishing. A curing day is any calendar day in which the temperature is above 50 degrees F for at least 19 hours. Colder days may be counted if air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at the end of calendar days equal to twice the required number of curing days. However, leave soffit forms and
shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Port Construction Representative.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for the full curing period. Keep wood forms wet during the curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging the surface.
2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received a final finish and surplus water sheen has disappeared, immediately seal surface with a uniform coating of approved curing compound, applied at the rate of coverage recommended by manufacturer or as directed by the Port Construction Representative. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of the compound.
2. Thoroughly agitate the compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.
3. Do not apply compound to a dry surface. If concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or if rain falls on a newly coated surface before film has dried sufficiently to resist damage, apply an additional coat of compound at the specified rate of coverage.

3.9 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for the required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Port Construction Representative.

3.10 DEFECTIVE WORK

A. Immediately repair any defective work discovered after forms have been removed. If concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace the entire section.
3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use a stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with the surface.

B. Apply a rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet the surface with a brush and perform first surface rubbing with No. 16 carborundum stone, or approved substitution. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce a smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved substitution. After rubbing, allow paste on the surface to reset; then wash surface with clean water. Leave structure with a clean, neat and uniform-appearing finish.

C. Apply a wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed in conformance with the requirements of the General and Special Conditions.

B. Unless otherwise directed by Port Construction Representative, the following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by an approved independent testing agency, and conform to the requirements of ASTM C 1077.

1. Take concrete samples in accordance with ASTM C 172.
2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test the specimens in accordance with ASTM C 31 and ASTM C 39.
3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.
4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, the specified 7-day and 28-day compressive strengths shall be applicable at 3 and 7 days, respectively.
E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. If additional curing fails to produce the required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Port Construction Representative, at no additional cost to the Port of Houston Authority.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by the Port of Houston Authority.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic, and whenever such precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Port Construction Representative.

END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES
A. Subject to the General and Special Conditions, this Section includes the requirements for concrete topping and concrete fill bonded to previously placed and cured concrete.

1.2  SUBMITTALS
A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Submit manufacturer's technical literature on bonding agent proposed for use by the Contractor. Include the manufacturer's printed installation and/or application instructions.

1.3  MEASUREMENT AND PAYMENT
A. Subject to Section III, no separate payment will be made for Bonded Concrete Topping and Fill under this Section. Include payment in unit price of items for which Bonded Concrete Topping and Fill is a component.

1.4  REFERENCES
B. American Concrete Institute (ACI): ACI 503.2 - Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.

PART 2  PRODUCTS

2.1  MATERIAL
A. Bonded Concrete Topping: Class D concrete as specified in Section 32 13 12.00 - Concrete Construction and on the Drawings.
B. Bonded Concrete: Class I concrete as specified in Section 32 13 12.00 - Concrete Construction and on the Drawings.
C. Latex Bonding Agent: Latex bonding agent shall be a non-reemulsifiable latex base liquid formulated for bonding wet concrete to hardened concrete. Bonding agent shall be suitable for use under continually submerged conditions.
D. Epoxy Bonding Agent: Shall permanently bond fresh wet concrete to cured concrete and shall conform to ASTM C 881, Type II. Grade and class shall be as required for the project application. A field service representative of the manufacturer shall be available during initial application to instruct the Contractor in the proper use of the product when so requested by the Port Construction Representative or the Contractor.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Protect the raked, base-slab finish from contamination until the time of topping. Mechanically remove oil, grease, asphalt, paint, clay stains or other contaminants, leaving a clean surface.

B. Prior to placement of the topping, thoroughly dampen the roughened slab surface and leave free of standing water. Prepare bonding grout by mixing approximately one part cement and one part fine sand using a No. 30 mesh sieve. Mix to a consistency of thick cream. Immediately before topping is placed, scrub a coat of bonding grout into the surface. Do not allow the grout to set or dry before the topping is placed.

C. As an alternate method of bonding the topping to the base slab, the Contractor may use a commercially prepared latex bonding agent used in strict accordance with the manufacturer's recommendations and instructions. Prior to placement of the concrete topping or fill, coat the surface of the base concrete with a commercially prepared latex bonding agent used in strict accordance with the manufacturer's recommendations and instructions.

D. Another acceptable alternate is an epoxy bonding agent. Prior to placement of the concrete topping or fill, coat the surface of the base concrete with an epoxy bonding agent. Prepare surface to be bonded and apply bonding agent in strict accordance with the manufacturer's instructions and ACI 503.2, except that surface preparation by acid etching will not be allowed. When ACI 503.2 references ACI 301, delete ACI 301 and substitute with 03 30 00.00 - Concrete Construction.

3.2 BONDED CONCRETE TOPPING

A. Provide a bonded concrete topping at all locations shown on the Drawings.

B. Shape, consolidate, check for trueness of surface and float finish as specified in Section 32 13 12.00 - Concrete Construction, Item 3.9, Finishing of Concrete Surfaces.

3.3 CONCRETE FILL

A. Place concrete and shape to slopes indicated on the drawings. Surfaces of concrete fill shall be given a wood float finish.

B. Provide concrete fill at all locations shown on the drawings.
3.4 CURING

A. Curing of bonded concrete topping and fill shall conform to the requirements of Section 32 13 12.00 - Concrete Construction.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 13 20.00 Add - CONCRETE JOINTS AND EMBEDDED ITEMS

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes requirements for concrete joints, including joint fillers and sealants, and embedded items for all cast-in-place concrete except as noted below.

1.2  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Shop Drawings: Submit shop drawings showing all concrete joints, proposed sequences for concrete placement and type of concrete specified. This information may be shown on the reinforcing steel shop drawings.

C. Product Data: Submit manufacturer's technical literature on product brands, proposed for use by the Contractor. The submittal shall include the manufacturer's installation and/or application instruction. Submittals shall be made on the following products:

   1. Expansion joint fillers.
   2. Joint sealing compound and primer.
   4. Elastomeric compression seal.
   5. Plastic adhesive waterstop.

D. Samples: Submit two minimum 8-inch-long samples of the proposed preformed elastomeric expansion joint compression seal.

E. Laboratory Reports:

   1. Submit certification by a certified independent testing laboratory that the waterstops meet or exceed the physical requirements of CRD-C572.
   2. Submit reports from a certified independent testing laboratory certifying that the elastomeric compression seal type preformed expansion joint sealer conforms to ASTM D 2628.

1.3  MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for concrete joints and embedded items under this Section. Include cost of Concrete Joints and Embedded Items in the unit price of items for which concrete joints and embedded items are a component.
1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

5. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

B. Federal Requirements:

1. TT-S-00227E(3) - Sealing Compound Elastomeric Type, Multi-Component (for Calking, Sealing and Glazing in Buildings and Other Structures).
2. TT-S-00230C(2) - Sealing Compound Elastomeric Type, Single Component (for Calking, Sealing and Glazing in Buildings and Other Structures).


D. American Concrete Institute (ACI): ACI 503.2 - Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.

PART 2 PRODUCTS

2.1 EXPANSION AND ISOLATION JOINT FILLER

A. Bituminous Joint Filler: Preformed bituminous type conforming to ASTM D 994 or cane fiber asphalt-impregnated type conforming to ASTM D 1751. Provide 3/4-inch-thick filler unless otherwise shown. Use bituminous joint filler at the following locations:

1. Expansion joints between paving and structures.
2. Building floor slab expansion and isolation joints.

B. Joint Filler, Nonbituminous (Polyethylene Foam Type): Nonbituminous joint fillers shall be a closed-cell polyethylene foam. The joint filler shall be structurally strong, ultraviolet stable and resistant to oils, chemicals, ozone and weathering. The filler shall be
compressible without extruding the sealant and shall have superior recovery properties. The material shall be inert and compatible with cold-applied sealants. Cold-applied sealants shall not adhere to the filler. Use nonbituminous joint filler at locations shown on the Drawings.

C. Joint Fillers, Nonbituminous (Cork Type): Preformed Type III self-expanding cork filler conforming to ASTM D 1752. Use at locations shown on the drawings.

D. Joint Filler, Board Type: Selected stock, clear heart redwood boards weighing not more than 30 pounds per cubic foot, when oven dried to constant weight; or clear, all-heart cypress weighing not more than 40 pounds per cubic foot, after being oven dried to constant weight. Use boards free of any defects which would impair usefulness as joint material. Use at the locations shown on the Drawings.

2.2 JOINT SEALING COMPOUND

A. Joint sealing compound used on joints in liquid containing structures shall be suitable for continuously submerged service. Provide joint primer according to manufacturer’s recommendation. Joint sealing compound conforming to ASTM D 1190 shall be used at the following joints:

1. Expansion joints between paving and structures.
2. Building floor slab expansion joints, control joints and construction joints.

B. Single- or multi-component urethane joint sealing compound conforming to ASTM C 920, Grade 25. Type, grade and use classification shall be as required for the specific location of use. Material shall be suitable for use in continuously submerged service. Use at locations shown on the Drawings.

B. Single- or multi-component cold-applied urethane type joint sealants conforming to Federal Specification TT-S-00227E for a multi-component sealant or Federal Specification TT-S-00230C for a single-component sealant. Sealant shall be Class A, Type I or II as required by the project application. Sealant shall be gray in color. Material shall be suitable for use in continuously submerged service. Provide joint primer according to manufacturer’s recommendation. Use at locations shown on the Drawings.

2.3 EPOXY JOINT FILLER

A. Two-component, resilient epoxy filler. The material shall be 100 percent solids with a minimum Shore D hardness of 50 (ASTM D 2240) and minimum elongation of 6 percent (ASTM D 638). Use in construction and control joints at locations shown on the Drawings.

2.4 PREFORMED EXPANSION JOINT SEALER, ELASTOMERIC COMPRESSION SEAL TYPE

A. The material used in the manufacture of the preformed expansion joint sealer shall conform to the requirements of ASTM D 2628. The sealer shall be in extruded strip form with smooth surfaces, shall be in straight lengths and shall meet the cross-sectional dimensions shown on the drawings and the tolerances specified. The lengths furnished shall provide continuous placement with no joints.

B. The manufacturer shall furnish certified tests of compliance with the requirements of ASTM D 2628.
C. Dimension tolerances shall be as follows:

1. Width: 0 + 3/16 inch.
2. Height: 0 + 1/8 inch.
3. Web thickness: 0 + 1/64 inch.

D. Lubricant and adhesive used in the installation of the compression seal shall conform to the requirements of the seal manufacturer.

E. Use at locations shown on the drawings.

2.5 CONCRETE BONDING AGENTS

A. Epoxy Bonding Agent: Shall permanently bond fresh wet concrete to cured concrete and shall conform to ASTM C 881, Type II. Bonding agent shall develop the full strength of the concrete. Grade and class shall be as required for the project application. A field service representative of the manufacturer shall be present during initial application to instruct the Contractor in the proper use of the product when so requested by the Port Construction Representative or the Contractor.

B. Latex Bonding Agent: Non-reemulsifiable latex base liquid formulated for bonding wet concrete to hardened concrete and for mixing with cement mortar. Bonding agent shall be certified by the manufacturer for use in a continuously submerged environment.

2.6 BOND BREAKER

A. 30-pound asphalt saturated felt, installed when called for in the plans.

2.7 EXPANSION JOINT DOWELS

A. Smooth steel bars conforming to the requirements of Section 03 21 00.00 - Reinforcing Steel. Cut dowels to length at shop or mill before delivery to the site. Dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and extends no more than 0.04 inch from the end.

2.8 SLEEVES

A. ASTM A 53, Type E or S, Grade B, welded or seamless. No hydrostatic test required.

2.8 SLEEVES

A. Rigid Schedule 20 PVC pipe.

2.9 WATERSTOPS

A. PVC Waterstops: PVC waterstops shall be made of virgin polyvinyl chloride compound and shall conform to the requirements of the Corps of Engineers’ Specification CRD-C572. The waterstops shall be produced by an extrusion process and shall be uniform in dimension, homogeneous and free from porosity. Unless otherwise shown, use waterstops of 6-inch minimum width and 3/8-inch minimum thickness. See plans for location and type required. Waterstop construction:

2. Expansion Joints: Dumbbell type with a minimum 3/4-inch inside diameter center bulb.

B. Premolded Plastic Adhesive Waterstops: Premolded plastic adhesive waterstops shall be a cold-applied preformed plastic sealing compound produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes or obnoxious odors. The plastic waterstop shall not depend on oxidizing, evaporating or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded flat tape form of suitable cross section and of a size to seal the joint areas of concrete sections. Minimum cross-sectional areas shall be one square inch. The plastic waterstop shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half, to facilitate application of the sealing compound. The plastic waterstop shall meet or exceed all the requirements of Federal Specification SS-S-00210.

C. Hydrophilic Expansion Rubber Waterstop/Seal: Where shown on the drawings, provide a waterstop/seal of a compound of hydro-swelling resin and chloroprene rubber of high resilience. The hydrophilic waterstop shall swell upon contact with water.

1. Waterstop: Where indicated in concrete construction, use a waterstop consisting of hydrophilic expansion rubber and butyl rubber. Minimum swelling ratio shall be 1.7 times the original volume.

2. Seal: Where indicated for precast elements, use a seal composed of hydrophilic expansion rubber with a minimum swelling ratio of two times the original volume.

2.10 MISCELLANEOUS EMBEDDED METAL ITEMS

A. Miscellaneous embedded metal items shall conform to the requirements of the section of the specifications to which they apply.

PART 3 EXECUTION

3.1 GENERAL

A. Place embedded items to least impair strength of the structure. Obtain approval of locations for embedded items not shown on the structural drawings before placement of concrete. Should locations of embedded items be detrimental to the strength of the structure, notify the Port Construction Representative and relocate items as directed by the Port Construction Representative.

B. Do not cut or reposition reinforcing steel to facilitate installation of inserts, conduit, sleeves, anchor bolts, mechanical openings and similar items without prior approval of the Port Construction Representative, except that reinforcing bars may be moved one bar diameter or within tolerances specified in 03 21 00.00 - Reinforcing Steel without prior approval.

3.2 CONSTRUCTION JOINTS

A. Make construction joints only at locations shown on the contract drawings, the reviewed shop drawings or as directed or approved by the Port Construction Representative. Any additional construction joints or relocation of construction joints shown on the drawings, proposed by the Contractor, shall be submitted for review.
A. Construction joints shall be located as shown on the drawings. Additional construction joints shall be located by the Contractor as follows:

1. Foundation slabs - maximum spacing of 30 feet.
2. Walls - maximum spacing of 30 feet. Corners shall be placed with construction joints at approximately 15 feet from the corner in each direction. Concrete shall be placed in alternate sections. The concrete shall be cured for a minimum of 7 days before placing concrete in the adjacent section.
3. Submit the proposed location of construction joints and placing sequence for review.

B. Joints shall be located to least impair strength of the structure. In general, locate joints near the middle of spans of slabs, beams and girders. However, if a beam intersects a girder at the joint, offset joints in girders a distance equal to twice the width of the beam. Locate joints in walls and columns at the underside of floors, slabs, beams or girders and at tops of footings or floor slabs. Place beams, girders, column capitals and drop panels monolithic with slabs. Place brackets and haunches monolithic with walls and columns.

C. All joints shall be perpendicular to main reinforcement. With in foundation slabs, continue all reinforcing steel and WWF across construction joints. Unless otherwise shown, provide longitudinal keys at least 1-1/2 inches deep by one third of the wall thickness, centered in the wall, in all joints in walls and slabs and between walls and slabs or footings. When joints in beams are allowed, provide shear key and inclined dowels as directed by the Port Construction Representative.

D. Construction joints in slabs on ground shall have a groove in the top of the slab, at the joint, as detailed to receive joint sealant.

E. Prepare joints by roughening the concrete surface in a manner which will expose aggregate uniformly. Remove laitance, loosened particles of aggregate, damaged concrete at surface, and other substances which may prevent complete adhesion. Prior to placing concrete, coat the joint surface with a mixture of neat cement grout.

F. In lieu of the above method for securing bond between new and set concrete, the following optional method may be used. Use a latex bonding agent as specified applied to roughened and cleaned surfaces of set concrete in strict accordance with manufacturer's recommendations and these specifications with respect to preparation of surfaces and applications of bond agent.

G. Provide waterstops in all wall and slab construction joints as specified and where shown on the Drawings.

3.3 EXPANSION JOINTS

A. Do not extend reinforcement or other embedded metal items that are continuously bonded to concrete through any expansion joints.

B. Position expansion joint filler material accurately. Support against displacement during concrete placement and vibration. Place filler the full depth of the member less an allowance to form a groove for sealant as detailed.

C. Cork-type expansion joint filler material shall be installed in strict accordance with the manufacturer's instructions. Do not nail cork joint filler to forms or previously cast concrete. Attach with rubber cement or as recommended by the manufacturer.
D. Elastomeric compression seals shall be installed at locations shown on the drawings. Splices are not permitted without approval of the Port Construction Representative. Installation shall be in strict accordance with manufacturer’s recommendations with respect to preparation, cleaning, application of lubricant-adhesive and insertion of the compression seal with proper tools.

3.4 DOWELS

A. Where indicated on drawings, install smooth dowels at right angles to construction joints and expansion joints. Aline dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the Drawings, apply oil or grease to one end of all smooth dowels.

3.5 ISOLATION JOINTS

A. Do not extend reinforcement or other embedded metal items through any isolation joints.

B. Position expansion joint filler material accurately. Support against displacement during concrete placement and vibration. Place filler the full depth of the member less an allowance to form a groove for sealant as detailed.

3.6 CONTRACTION JOINTS

A. Make top grooves for contraction joints in slabs on grade as detailed and seal as specified. Grooves may be made with forms or may be sawed.

B. If contraction joints are sawed, properly time cutting with concrete set. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses have developed sufficiently to induce cracking.

3.7 EPOXY BONDED JOINTS

A. Epoxy bonded joints shall be used only where shown on the drawings, where specified, or upon written approval of the Port Construction Representative. Prepare surface to be bonded and apply bonding agent in strict accordance with the manufacturer’s instructions and ACI 503.2, except that surface preparation by acid etching will not be allowed. When ACI 503.2 references ACI 301, delete ACI 301 and substitute with 03 30 00.00 - Concrete Construction. Forms in the area of the bonded joint shall be properly protected so that any bonding agent that may be inadvertently applied to the form will not bond the form to the concrete.

3.8 WATERSTOPS

A. Provide waterstops in all horizontal and vertical joints in foundation slabs and peripheral walls of all structures up to a minimum of 12 inches above final ground level and all walls and slabs of liquid-containing structures or compartments to a minimum of 12 inches above maximum liquid level unless specifically shown otherwise on the drawings. In addition, provide waterstops in joints of interior walls of liquid containing structures when shown on the Drawings.

B. Waterstops shall be 6” x 3/8” PVC waterstops except at locations where premolded plastic adhesive waterstops or hydrophilic waterstops are shown on the drawings.
C. Each piece of premolded waterstop shall be of maximum practicable length for a minimal number of end joints.

1. Make splices at intersections and at ends of pieces in a manner most appropriate to the material being used and in accordance with manufacturer’s recommendations. Joints must develop effective watertightness fully equal to that of continuous waterstop material, must permanently develop not less than 50 percent of mechanical strength of parent section, and must permanently retain flexibility. Whenever possible, the manufacturer’s thermostatic splicing tool shall be used.

2. Hydrophilic Waterstop. Joint surface must be clean and dry. Butt ends of waterstop together (do not overlap). Any material that exhibits swelling prior to confinement in the joint must be replaced with new material.

D. Accurately position and support waterstops against displacement during concrete placement.

3.9 SEALING JOINTS

A. Apply sealant at all expansion and isolation joints, construction joints in slabs on grade and at other locations as shown on the Drawings.

A. Apply epoxy joint sealing compound in all construction and control joints.

B. Do not apply sealants until all curing shrinkage has taken place.

B. Do not apply sealants until all curing shrinkage has taken place, or a minimum of 3 months after the concrete has been cast, whichever occurs later. Care shall be taken not to damage the edges of the joints during this period.

C. Thoroughly clean and prime joints to be sealed before applying sealant. Joints to be sealed are identified on the Drawings.

D. Apply sealants in accordance with manufacturer’s recommendations.

E. Sealant shall be applied when the ambient temperature is between 40°F and 90°F, unless recommended otherwise by the sealant manufacturer.

F. During pouring operations, exercise care to prevent sealant from spilling onto surfaces adjacent to grooves.

3.10 EPOXY JOINT FILLER

A. At contraction or construction joints to be filled with epoxy joint filler. The epoxy joint filler shall be mixed and installed in strict accordance with the directions of the manufacturer. The joints shall not be filled sooner than 90 days after slab placement.

3.11 SETTING ANCHOR BOLTS

A. Set anchor bolts specified in other sections according to this section.

B. Install equipment anchor bolts as required by the equipment manufacturer.

C. Provide accurately made templates for positioning anchor bolts.
3.12 OTHER EMBEDDED ITEMS

A. It is the Contractor’s responsibility to coordinate the requirements for embedded items and to ensure that embedded items are properly placed.

B. Accurately position and support embedded items against displacement during concrete placement.

C. Voids in sleeves, inserts, anchors, etc., shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

D. Steel items, except reinforcing, shall be galvanized unless specified or shown otherwise. Galvanized embedded items shall not be in contact with the reinforcing steel or ungalvanized steel items.

E. Conduits, pipes and inserts of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

F. Except when plans for conduits and pipes are approved by the Port Construction Representative, conduits and pipes embedded within a slab, wall or beam (other than those merely passing through) shall satisfy the following:

1. They shall not be larger in outside dimension than 1/3 the overall thickness of slab, wall or beam in which they are embedded.
2. They shall not be spaced closer than three diameters or widths on center.
3. They shall not significantly impair the strength of the member.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 13 21.00 Add - JOINTS IN CONCRETE STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes waterstops and similar joints in concrete structures intended to retain water or withstand hydrostatic pressure.

1.2 RELATED SECTIONS

A. 03 30 00.00 – Cast-in-Place Concrete

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

F. ASTM D 746 - Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.


1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment will be made for joints in concrete structures under this Section. Include payment in unit price of items for which joints in concrete structures is a component.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Product Data: Information sufficient to indicate compliance with Contract Documents, including manufacturer's descriptive literature and specifications.

C. Shop Drawings: Indicate type, size, and location of each joint in each structure, and installation details.

D. Samples: For extrusions, submit 6-inch lengths. For molded or fabricated items, submit whole items. Submit 6-inch beads for sealants and 6-inch square samples for coatings, on appropriate substrates.

E. Quality Control Submittals: Submit manufacturer's instructions and recommendations for storage, handling and installation including material safety data sheets, and, where specified, test reports certified by an independent testing laboratory or the manufacturer, and manufacturer's certification that products furnished comply with Contract Documents.

1.6 DEFINITIONS

A. The following definitions refer to concrete joints in water-retaining structures. Unless otherwise indicated, all such joints shall have a waterstop or sealant groove to prevent water penetration at the joint.

B. Construction Joint: The joint or surface between two concrete pours, produced by placing fresh concrete in contact with a hardened concrete surface.

1. A bond breaker may or may not be used, as indicated.
2. Reinforcing steel is continuous through the joint, unless otherwise indicated.

C. Contraction Joint: A joint similar to a construction joint, but intended to accommodate concrete shrinkage and similar movement.

1. A bond breaker is always used.
2. Reinforcing steel is held back 4-1/2 inches from the joint surface, and sleeved dowels are used so pours can move apart, unless otherwise indicated.
D. Expansion Joint: A joint similar to a construction or contraction joint, but intended to accommodate both expansion and contraction.

1. Compressible joint filler is placed against the hardened concrete, to form and separate the second pour so pours can move together or apart.
2. A centerbulb waterstop and joint sealant are used to fill the gap, unless otherwise indicated.
3. Reinforcing steel is held back, and sleeved dowels are used to allow and control movement, unless otherwise indicated.

E. Control Joint: A groove cut or formed in the face of a single pour, producing a weaker plane more likely to crack; used in an attempt to control locations of normal shrinkage cracks.

1. Joint sealant is used to fill the groove.
2. Reinforcing steel is continuous, since the pour is monolithic.

1.7 QUALITY ASSURANCE

A. Waterstop Inspection: Notify the Port Construction Representative to schedule inspection at least 24 hours prior to work involving waterstop installation or fabrication of waterstop field joints.

B. Defects include but are not limited to the following:

1. Offsets at joints greater at any point than 1/16 inch or 15 percent of material thickness, whichever is less.
2. Exterior cracks at joints due to incomplete bond, which are deeper at any point than 1/16 inch or 15 percent of material thickness, whichever is less.
3. At any point, any combination of offsets or exterior cracks resulting in a net reduction in the cross-sectional area of the waterstop greater than 1/16 inch or 15 percent of material thickness at any point, whichever is less.
4. Misalignment of joint resulting in misalignment of the waterstop in excess of 1/2 inch in 10 feet.
5. Porosity in the welded joint as evidenced by visual inspection.
6. Bubbles or inadequate bond which can be detected with a pen knife. If, while probing the joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint is defective.

C. Field Joint Samples: Prior to use of the waterstop material in the field, fabricate and submit for review a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used. Fabricate samples so material and workmanship represent fittings to be furnished. Field samples of fabricated fittings (crosses, tees, etc.) will be selected at random by the Port Construction Representative for testing by an independent testing laboratory selected and paid for by the Port of Houston Authority. Tensile strength across the joints equal to at least 600 psi when tested in accordance with ASTM D 638. Contractor shall pay cost of failed tests and retesting required by failures.

D. Construction Joint Sealant: Prepare adhesion and cohesion test specimens, as specified, at intervals of 5 working days while sealants are being installed.

E. Sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:
1. Prepare sealant specimen between 2 concrete blocks (1 inch by 2 inches by 3 inches); spacing between the blocks shall be 1 inch. Use coated spacers (2 inches by 1-1/2 inches by 1/2 inch) to ensure sealant cross-sections of 1/2 inch by 2 inches with a width of 1 inch.

2. Cast and cure sealant according to manufacturer's recommendations except that curing period shall be not less than 24 hours.

3. Following curing period, widen the gap between blocks to 1-1/2 inches. Use spacers to maintain this gap for 24 hours prior to inspection for failure.

F. Sealant Installer: A competent waterproofing specialty contractor, approved by sealant manufacturer, having a record of successful performance in similar installations. Before beginning work, sealant manufacturer's representative shall instruct installer's crew in proper method of application.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in accordance with manufacturer's printed instructions.

B. Store waterstops to permit free circulation of air around waterstop material.

PART 2 PRODUCTS

2.1 EPA Potable Classification

A. All joint materials shall be materials that reach acceptability for use in potable water systems no later than 30 days after installation, as classified by the Environmental Protection Agency (EPA).

2.2 PVC Waterstops

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that the material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops: As detailed, and as manufactured by: Kirkhill Rubber Co., Brea, California; Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or approved substitution acceptable to the Port Construction Representative, provided that at no place shall waterstop thickness be less than 3/8 inch.

C. Multi-Rib Waterstops: As detailed, and as manufactured by Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or approved substitution acceptable to the Port Construction Representative. Use prefabricated joint fittings at intersections of ribbed-type waterstops.

D. Other Waterstops: When types of waterstops not listed above are indicated on the Drawings, they are subject to these specifications.

E. Waterstop Properties: When tested in accordance with specified standards, waterstop material shall meet or exceed the following requirements:
<table>
<thead>
<tr>
<th>Physical Property, Sheet Material</th>
<th>Value</th>
<th>ASTM Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength-min (psi):</td>
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<td>D638, Type IV</td>
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<tr>
<td>Ultimate Elongation-min (percent):</td>
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<td>D638, Type IV</td>
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<tr>
<td>Low Temp Brittleness-max (degrees F):</td>
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<tr>
<td>Stiffness in Flexure-min (psi):</td>
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<td>D747</td>
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<tr>
<td>Accelerated Extraction (CRD-C572) -</td>
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<tr>
<td>Tensile Strength-min (psi):</td>
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<td>D638, Type IV</td>
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<tr>
<td>Ultimate Elongation-min (percent):</td>
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<tr>
<td>Effect of Alkalies (CRD-C572) -</td>
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</tr>
<tr>
<td>Change in Weight (percent):</td>
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<tr>
<td>Change in Durometer, Shore A:</td>
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<tr>
<td>Finished Waterstop -</td>
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</tr>
<tr>
<td>Tensile Strength-min (psi):</td>
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<td>D638, Type IV</td>
</tr>
<tr>
<td>Ultimate Elongation-min (percent):</td>
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<td>D638, Type IV</td>
</tr>
</tbody>
</table>

2.3 Joint Sealant

A. Material: Polyurethane polymer designed for bonding to concrete which is continuously submerged in water. Use no material with an unsatisfactory history of bond or durability when used in joints of liquid-retaining structures.

B. Sealant Properties at 73 degrees F, 50 percent relative humidity:

1. Work Life: 45 - 180 minutes.
2. Time to Reach 20 Shore A Hardness (at 77 degrees F, 200 gr quantity): 24 hours, maximum.
5. Ultimate Elongation (ASTM D 412): 400 percent, minimum.
6. Tear Resistance (Die C ASTM D 624): 75 pounds per inch of thickness, minimum.

C. Polyurethane Sealants for Waterstop Joints in Concrete:

1. Sealant: 2-part polyurethane; when cured, sealant shall meet or exceed ANSI/ASTM C 920 or Federal Specification TT-S-0227 E(3) for 2-part material.
2. Vertical and overhead horizontal joints: Use only "non-sag" compounds meeting ANSI/ASTM C 920, Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.
3. Plane horizontal joints: Self-leveling compounds meeting ANSI/ASTM C 920, Class 25, Grade P, or Federal Specification TT-S-0227 E(3), Type I. For joints subject to either pedestrian or vehicular traffic, use a compound providing non-tracking characteristics and having a Shore A hardness range of 35 to 45.
4. Primer: Use only compatible materials manufactured or recommended for the application by the sealant manufacturer, in accordance with the printed instructions and recommendations of the sealant manufacturer.

E. Sealants for non-waterstop joints: Conform to Section 07 92 10.00 - Caulking and Sealants.

2.4 Miscellaneous Materials

A. Bearing Pad: ASTM D 2000 neoprene, Grade 2 or 3, Type BC, tensile strength 1450 psi, 60 durometer hardness, unless otherwise indicated.

B. Neoprene Sponge: ASTM D 1056, Type 2C3-E1 closed-cell expanded neoprene.

C. Preformed Joint Filler: ASTM D 1752 Type I non-extruding type; neoprene sponge or polyurethane of firm texture, except as otherwise specified. Bituminous fiber type will not be permitted.

D. Control Joint Former: Continuous plastic insert strips with anchorage ribs located at the bottom and an enlarged upper portion that is readily removable without damage to the concrete, and is sized to form sealant groove. Size to extend to at least 1/4 slab depth.

E. Backing Rod: Extruded closed-cell polyethylene foam rod, compatible with joint sealant materials used, with a tensile strength not less than 40 psi, and compression deflection approximately 25 percent at 8 psi. Size: 1/8-inch larger in diameter than joint width, except use one-inch diameter rod for 3/4-inch wide joints.

F. Bond Breaker: "Super Bond Breaker" manufactured by Burke Company, San Mateo, California; "Select Cure CRB", manufactured by Select Products Co., Upland, California, or approved substitution acceptable to the Port Construction Representative Bond breaker shall contain a fugitive dye so areas of application will be readily distinguishable.

G. Slip Dowels: Smooth steel bars conforming to ASTM A 615.

H. PVC Tubing: ASTM D 2241, Schedule SDR 13.5.

2.5 Resilient Waterstop

A. Resilient waterstop, where called for on the Drawings, shall be either a bentonite or adhesive type material.

B. Bentonite Waterstop:

1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
2. Manufacturers rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C. Adhesive Waterstop:
1. Adhesive waterstop shall be at least 2 inches in diameter and shall be Synko-Flex preformed plastic adhesive waterstop by Synko-Flex Products, Inc., or approved substitution. The waterstop shall meet or exceed requirements of Federal Specification SS-S-210A.

2. The adhesive waterstop shall be supplied wrapped completely by a two part protective paper.

3. The adhesive waterstop material shall have independent laboratory tests verifying that the material seals joints in concrete against leakage when subjected to a minimum of 30 psi water pressure for at least 72 hours.

4. Primer, to be used on hardened concrete surfaces, shall be provided by the same manufacturer as the waterstop material.

PART 3 EXECUTION

3.1 Installation

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 Splices In Waterstops

A. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.

1. Do not damage material by heat sealing.
2. Splice tensile strength: At least 60 percent of unspliced material tensile strength.

B. Butt end-to-end joints of 2 identical waterstop sections may be made in the forms during placement of waterstop material.

C. Prior to placement in formwork, prefabricate all waterstop joints involving more than 2 ends to be joined together, an angle cut, an alignment change, or the joining of 2 dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval by the Port Construction Representative, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24-inch strips to the straight-run portions of waterstop in the forms.

D. Where a centerbulb waterstop intersects and is joined to a non-centerbulb waterstop, take care to seal the end of the centerbulb, using additional PVC material if needed.

3.3 Joint Construction

A. Setting Waterstops:
1. Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in concrete. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.

2. Flat-strip waterstop: Prevent folding over by concrete during placement. Unless otherwise shown, hold waterstops in place with wire ties on 12-inch centers passed through the waterstop edge and tied to reinforcing steel.
   a. Horizontal waterstops (with flat face in vertical plane): Hold in place by fastening upper waterstop edge to continuous supports.
   b. Horizontal waterstops (with flat face in horizontal plane): Work concrete under waterstops by hand to eliminate air and rock pockets.

3. Place centerbulb waterstops in expansion joints centered on joint filler material.

4. Where a waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.

B. Joint Location: Unless specifically noted otherwise, provide construction joints at 25-foot maximum spacing for concrete construction. Where joints are shown spaced greater than 40 feet apart, provide additional joints to maintain the 25-foot maximum spacing. Submit joint locations for review by the Port Construction Representative.

C. Joint Preparation: Prepare surfaces in accordance with Section 03 30 00.00 – Cast-in-Place Concrete. Unless otherwise indicated, bonding is required at horizontal concrete joints in walls. Except on horizontal wall construction joints, wall-to-slab joints, or where otherwise shown or specified, at joints where waterstops are required, coat the joint face of the first pour with bond breaker as specified.

D. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Contract Documents.

E. Construction Joint Sealant:

1. In water-bearing floor slabs and elsewhere where indicated, provide construction joints with tapered grooves filled with construction joint sealant. Leave groove-forming material in place until time grooves are cleaned and filled with joint sealant. After removing groove forms, remove laitance and fins and sand-blast the grooves. Allow grooves to dry thoroughly, then blow out, immediately prime surfaces, place bond-breaker tape in bottom of groove and fill with construction joint sealant. Use no sealant without a primer. Completely fill sealant grooves. Thoroughly clean areas designated to receive sealant, as specified for tapered grooves, prior to sealant application.

2. Mix and install primer and sealant in accordance with manufacturer's printed instructions and recommendations. Do not coat sides of sealant groove with bond breaker, curing compound or other substance which would interfere with proper sealant bond. Allow at least 7 days for sealant to achieve final cure before filling structure with water.

3. Thoroughly and uniformly mix 2-part catalyst-cured material.

4. Remove and replace improperly cured sealants after the manufacturer's recommended curing time; thoroughly sandblast the groove to remove all traces of uncured or partially-cured sealant and primer, then re-prime and re-seal with specified sealant.
F. Resilient Waterstop:

1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations except as otherwise indicated and specified.

2. When requested by the Port Construction Representative, provide technical assistance by manufacturer's representative in the field at no additional cost to the Port of Houston Authority.

3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form a smooth joining surface.

5. At the free top of walls without connecting slabs, stop the resilient waterstop and grooves (where used) 6 inches from the top in vertical wall joints.

6. Bentonite Waterstop:
   a. Locate bentonite waterstop as near as possible to the center of the joint and extend continuous around the entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.
   b. Where thickness of the concrete member to be placed on the bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1-1/4 inches wide or ground into the concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.
   c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm the material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.
   d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth if necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using an epoxy grout which completely fills voids and irregularities beneath the waterstop material. Prior to installation, wire brush the concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.
   e. In addition to the adhesive backing provided with the waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-inch maximum spacing.

7. Adhesive Waterstop:
   a. Thoroughly clean the concrete surface on which the waterstop is to be placed with a wire brush and coat with primer.
   b. If the surface is too rough to allow the waterstop to form a complete contact, grind to form an adequately smooth surface.
   c. Install the waterstop with the top protective paper left in place. Overlap joints between strips a minimum of 1 inch and cover back over with the protective paper.
   d. Do not remove protective paper until just before final formwork completion. Concrete shall be placed immediately. The time that the waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

G. Control Joints:
1. Where indicated, form in slabs by sawcutting, preformed plastic inserts or other means acceptable to the Port Construction Representative. Minimum insert or sawcut: 1/4 slab depth.

2. Perform sawcutting during the curing period as soon as possible after concrete has reached its final set, has attained sufficient strength to support sawcutting operations without damage, and while it remains fully saturated.

3. Leave the removable portion of plastic inserts in place and protect sawcuts against damage and intrusion of foreign material until the end of the curing period and until concrete has dried sufficiently to allow sealant installation.

4. Sealant Installation: Blow foreign material from formed or sawcut space. Insert a foam backer rod to form a sealant depth equal to the width of the space but not less than 3/8 inch. Install sealant as specified elsewhere in the Contract Documents.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 17 23.01 Add - PAVEMENT MARKING AND SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes basic requirements specifically applicable to the work of Division 32 – Exterior Improvements.

B. This section includes furnishing and placing of temporary painted pavement markings.

C. Signage.

1.2 RELATED SECTIONS

A. Section 32 13 13.02 - Concrete Pavement.

B. Section 32 13 13.01 – Roller Compacted Concrete Paving.

1.3 REFERENCES

A. Harris County Specification - Traffic Paint (Solvent Based).

B. TxDOT Manual of Testing Procedures Tex-829-B - Measuring Pavement Temperatures

1.4 MEASUREMENT AND PAYMENT

A. Payment for “Pavement Marking Stripes” shall be on a unit price basis per Linear Foot for each color and width as indicated on the Plans, measured complete in place and accepted.

B. Payment for 2”x12” “Gate Red Stripe” to be painted on either side of the trench gate openings, shall be paid for per Linear Foot, measured complete in place and accepted.

C. Payment for “Pavement Marking Arrows” shall be on a unit price basis per each, measured complete and in place and accepted.

D. Payment for “STOP” shall be on a unit price basis per Each word (all four letters), painted 6 foot high, measured complete and in place and accepted.

E. Payment for “Pavement Marking Numerals” shall be on a unit price basis per Each location for each color and size, measured complete and in place and accepted. (Two numerals per Each location for 20” high Yellow Numerals).
F. Payment for “Pavement Marking Letters (3’)” shall be on a unit price basis per each location for each color and size, measured complete and in place and accepted for 3 foot high Letters. (One letter per each location for 3’ high letters).

G. Payment for “Warning Sign & Buoy” shall be on a Lump Sum basis per each sign unit and buoy, including base, posts, supports, sign panels and paints, and includes Buoy Marker. Complete assembly measured complete in place and accepted.

H. Payment for “Concrete Barrier Markings” shall be on a unit price Lump Sum basis for providing all markings on all the concrete barriers, indicated in the Plans. Payment for the concrete barrier is not included in this pay item. See “Furnish and install Concrete Barrier’ described in Section 32 31 13.00 - FENCE AND GATES. (Payment for the Concrete Barrier shall be made on a unit price basis per linear foot for furnish and install Concrete Barrier.)

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Test data.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's application directions, and name of manufacturer.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Do not store or install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 MATERIALS

A. Line and Zone Marking Paint: in accordance with Harris County Specification Item 661; color(s) as indicated.
   1. Roadway Markings or Parking Lots: Yellow or white, as indicated.
   2. Handicapped Symbols: Blue or white, as indicated.

B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.
C. Signage materials and dimensions to be in accordance with Contract Drawings.

2.2 EQUIPMENT

A. Equipment used to place pavement markings shall:

1. Be maintained in satisfactory operating condition.
2. Be considered in satisfactory operating condition if it has an average placement rate of 5,000 linear feet per hour of acceptable four-inch solid or broken lines over any five (5) consecutive working days.
3. Meet or exceed the material handling at elevated temperature requirements of the National Fire Underwriters and the Texas Railroad Commission.
4. Have production capabilities considered satisfactory by the Port Construction Representative when used to place markings other than solid or broken lines.
5. Be capable of placing lines with clean edges and of uniform cross-section.
6. Have an automatic cut-off device with manual operating capabilities to provide clean, reasonably square marking ends to the satisfaction of the Port Construction Representative, and to provide a method of applying broken lines within specified tolerances.
7. Provide continuous mixing and agitation of the pavement marking material. Do not use pans, aprons or similar appliances for die overruns on longitudinal striping applications.

PART 3 EXECUTION

3.1 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

1. Pavement to which material is to be applied shall be completely dry. Pavements shall be considered dry if, on a sunny day after observation for 15 minutes, no condensation occurs on the underside of a one foot square piece of clear plastic that has been placed on the pavement and weighted on the edges.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Marking Removal: When indicated on the plans, or as directed by the Port Construction Representative, remove existing paint markings by use of a water-jet type “fantail”.

1. Care shall be exercised to protect existing pavement from damage. Removal of markings by grinding the pavement will not be permitted.

C. Clean surfaces thoroughly prior to installation.

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

E. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

F. Establish survey control points to determine locations and dimensions of markings;
provide templates to control paint application by type and color at necessary intervals.

G. Temporary Pavement Markings: When required or directed by Port Construction Representative, apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.

1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
2. At Contractor's option, temporary marking tape may be used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to the Port of Houston Authority.

3.2 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F or more than 95 degrees F.

1. Pavement temperature shall be measured in accordance with test method Tex-829-B, Measuring Pavement Temperatures, as described in the TxDOT Manual of Testing Procedures.

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on drawings.

1. Apply paint in one coat only, in 4-inch or 6-inch minimum widths, as indicated.
2. Wet Film Thickness: 0.015 inch, (15 mils) minimum.
3. Width Tolerance: Plus or minus 1/8 inch per 4 inch width.

G. Roadway Traffic Lanes: Use suitable mobile mechanical equipment that provides constant agitation of paint and travels at controlled speeds.

1. Conduct operations in such a manner that necessary traffic can move without hindrance.
2. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.
3. If paint does not dry within expected time, discontinue paint operations until cause of slow drying is determined and corrected.
4. Use hand application by pneumatic spray for application of paint in areas where a mobile paint applicator cannot be used.
H. Parking Lots: Apply parking space lines, entrance and exit arrows, and other markings indicated on drawings.

1. Mark the International Handicapped Symbol at indicated parking spaces.
2. Hand application by pneumatic spray is acceptable.

I. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

J. Signage to be installed in accordance with Contract Drawings.

3.3 APPLICATION TOLERANCES

A. Broken lines shall meet the following tolerances:

1. An approximate stripe-to-gap ratio of 8 to 16.
2. The length of the stripe shall not be less than 8 feet or more than 8.5 feet.
3. The total length of any stripe-gap cycle shall not be less than 15.5 feet or more than 16.5 feet.

3.4 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled, approved methods stated herein.

F. Replace removed markings at no additional cost to Port of Houston Authority.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 31 13.00 Add - FENCE AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes the furnishing of all labor, materials, equipment, supervision, and incidentals, and the performance of all work necessary to construct new fencing, including gates, posts, extension arms, chain link wire mesh, tension wires, barbed wire, bracing, attachments, and all other appurtenances, in accordance with these Specifications and as shown on the Drawings.

1.2 RELATED SECTIONS

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3 REFERENCES

(Not Applicable)

1.4 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.5 MEASUREMENT AND PAYMENT

A. Subject to Section III, furnish and install Concrete Barrier: Payment will be made on a unit price basis per Linear Foot for furnished Concrete Barrier. This item is for the concrete barriers utilized as traffic lane dividers and as lane markers. This item excludes the concrete barrier utilized for the security fencing that borders the facility.

B. Subject to Section III, furnish and install Double Row Metal Beam Guard Fence will be made on a unit price bases per Linear Foot for furnish rail, supports and all appurtenances.

C. Subject to Section III, Concrete Filled Steel Bollard: Payment will be made on a unit price basis per Each Bollard of the size (diameter) and types as indicated on the Plans, measured complete in place and accepted including all paintings and markings.

D. Furnish and install 5’–6” Chain Link Fence with 3-strand Barbed Wire on Concrete Barrier: Payment will be made on a unit price basis per Linear Foot for furnished fence, supports and three strand barbed wire to be placed on top of concrete barrier. This payment item is for the security fencing that borders the facility. Price for this item INCLUDES payment for the concrete barrier.
E. Subject to Section III, Furnish and install 8-foot Chain Link fence with 3-strand barbed wire: payment will be made on a unit price basis per Linear Foot for furnishing fence, supports, and 3-strand barbed wire, on pavement and on grade.

F. Subject to Section III, Furnish and install Pedestrian Gate: Payment will be made on a unit price basis per Each Pedestrian Gate as indicated on the Plans, measured complete, in-place including supports, locks all hardware and accepted.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials incorporated into the work shall be new and of first class manufacture and construction, and in accordance with the provisions of Paragraph MATERIAL SPECIFICATION, following.

2.2 MATERIAL SPECIFICATION

A. General: The Contractor shall provide all items, articles, materials, operations and methods listed, mentioned or scheduled, either on the Drawings or specified herein, or both, including appurtenances and incidentals, necessary and required for their completion.

B. Style of Fence: Chain link with three strands of barbed wire on 45-degree arms. Tension wires top and bottom. Overall height will be as shown on the drawings. Heavy-duty industrial type fence fittings and gates shall be used throughout.

C. Fabric: Fabric shall be either of the following:

1. No. 9 gauge chain link steel wire fabric 96 inches wide woven in a 2-inch mesh, with top and bottom selvages twisted and barbed, having a Class I hot-dipped zinc coating (1.2 oz. per sq. ft. of wire surface), and having a breaking strength of 1,290 pounds, all in accordance with ASTM Specifications A-392, latest revision. Galvanized coating shall be applied after weaving of the fabric; or

2. No. 9 gauge chain link steel wire fabric 96 inches wide woven in a 2-inch mesh, with top and bottom selvages twisted and barbed, having a Class II aluminum coating (0.40 oz. per sq. ft. of wire surface), and having a breaking strength of 1,290 pounds, all in accordance with ASTM Specifications A-491, latest revision.

D. Line Posts: Line posts shall be spaced on 8-foot centers and installed with a minimum of 36 inches of length embedded in concrete. Posts shall be equipped with 6 gauge aluminum coated or galvanized steel clips spaced on 14-inch maximum centers. Line posts shall be one of the following:

1. Galvanized steel Schedule 40 pipe, 2-3/8-inch OD, weighing 3.65 pounds or more per foot, complying with ASTM Specifications A-120, latest revision; or

2. Galvanized steel "C" section, 2.25 inches wide by 1.70 inches deep, weighing 2.64 pounds or more per foot, with a minimum yield strength of 45,000 psi.

E. End, Corner and Pull Posts: End, corner, and pull posts shall be Schedule 40 pipe 2-7/8-inch OD weighing 5.79 pounds or more per foot complying with ASTM Specifications A-120, latest revision, equipped with 3/16-inch by 3/8-inch tension bars, No. 11 gauge by 1-inch bands spaced on 14 inch maximum centers, and 3/8-inch carriage bolts and nuts.
Posts, bars, bands, bolts, and nuts shall be hot-dip galvanized. A minimum of 36 inches of length shall be embedded in concrete.

F. Extension Arms for Line and Posts:

1. Use pressed steel extension arms at all line posts. Use pressed steel or malleable iron extension arms at all corner posts. Extend post pipe above wire mesh to anchor ends of extension arm barbed wire strands at all gate posts and posts at the ends of the fence to be constructed (in lieu of separate extension arms at these gate and fence end posts) of sufficient length to support top strand of barbed wire at 12 inches above top of fabric.

2. All extension arms shall be designed to carry three strands of barbed wire, with the top strand to be 12 inches above and 12 inches horizontally out from top of fabric, except where the Drawings show the open gates folded back against the fence on the same side as extension arms use vertical extension arms with top strand 12 inches above top of fabric.

3. All 45-degree extension arms shall support safely a minimum weight 250 pounds applied at the end of the arm. Vertical arms shall have bending strength equivalent to that specified for 45-degree arms.

4. All extension arms shall be hot-dip galvanized after fabrication.

G. Top and Bottom Tension Wires: Use either No. 7 gauge aluminum coated steel wire with a minimum tensile strength of 80,000 psi and a minimum 0.40 oz. coating per square foot of wire, or No. 7 gauge galvanized coil spring steel wire of good commercial quality and having a minimum coating of 0.80 oz. per square foot of uncoated surface when tested in conformance with ASTM Specifications A-90, to be attached to chain link fabric with hog rings on 24-inch maximum centers. Except for braces, no top rail is required.

H. Barbed Wire: Each line of barbed wire shall have two strands of 12-1/2 gauge aluminum coated steel wire, twisted together, with 4-point aluminum or aluminum coated barbs of 14 gauge spaced on 5-inch centers. Minimum weight of aluminum coating shall be 0.30 oz. per square foot of wire surface for strands and 0.25 oz. per square foot of wire surface for barbs in accordance with ASTM Specifications A-585, latest revision. Galvanized barbed wire meeting the requirements of ASTM Specifications A-121, Class 3 coating, of the same wire gauges and construction as above may be substituted for aluminum coated wire.

I. Braces: Braces shall be furnished at all end, corner, and gate posts, as detailed on the Drawings. Use 1-5/8-inch OD galvanized pipe weighing 2.27 pounds per foot for horizontal and diagonal struts. Truss back from connection of horizontal strut at the line post to the base of the end, corner or gate post with 3/8-inch diameter galvanized rod complete with threaded truss tightened.

J. Gate Posts: Hinge posts for gates shall be galvanized steel pipe of size and length shown in Tabulation of Gates and Hinge Posts in the Drawings. Furnish galvanized steel closure caps for all gate posts. Hinge posts shall have the following minimum weights per foot of pipe:

<table>
<thead>
<tr>
<th>Post Size</th>
<th>Weight per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-7/8-inch OD Posts</td>
<td>5.79 lbs./ft.</td>
</tr>
<tr>
<td>4-inch OD Posts</td>
<td>9.11 lbs./ft.</td>
</tr>
<tr>
<td>6-5/8-inch OD Posts</td>
<td>18.97 lbs./ft.</td>
</tr>
<tr>
<td>8-5/8-inch OD Posts</td>
<td>24.70 lbs./ft.</td>
</tr>
</tbody>
</table>
K. Gates:

1. Construct gate frame of either 2-inch OD galvanized pipe weighing 2.72 pounds or more per foot, or 2-inch square galvanized tubing weighing 2.72 pounds or more per foot. The Contractor shall furnish gates with pressed steel corner ells, riveted with four rivets per corner, or gates with welded joint construction galvanized after fabrication. Intermediate vertical strut braces shall be of the size shown on the Drawing, either 1-3/8-inch OD galvanized pipe weighing 1.68 pounds per foot or 2-inch OD galvanized pipe weighing 2.72 pounds or more per foot. Gates shall have 3/8-inch diameter adjustable truss rods. All gates shall also conform to the details shown on the Drawings.

2. Hinges of all gates shall be heavy-duty industrial type of adequate strength to support the weight of the gate plus 100 percent overload for ice, without permanent distortion. The bottom hinge of all gates preferably shall be ball and socket type made of malleable iron. Gates shall be complete with malleable iron latch and locking hardware, center rest, and hold-back catches. Gates shall have fork at top and bottom of plunger rod. All components shall be hot-dip galvanized.

L. Pedestrian Control Equipment (Gates/Turnstiles):

1. Submittal - Shop Drawings: Submit project specific shop drawings and finish samples. Indicate pertinent dimensions, general construction, component connections and location, anchorage methods and location, hardware, and installation details.

2. Product Handling: Deliver material to job site in manufacturer’s packaging undamaged, complete with installation instructions. Store off ground, under cover, protected from weather and construction activities.

3. Warranty: Boon Edam warranties its products against defects in material and workmanship for a period of one year from the date of substantial completion or one and one half years from date of shipment. This warranty excludes glass breakage, normal wear on finishes or damage that occurs due to abuse, misuse or acts of God.

4. Turnstile Materials:
   b. Turnstile Construction:

      1. Mechanism Housing: Equipment is constructed from a 7-inch stainless steel channel. All electrical and mechanical components are attached to the channel. The channel and operating mechanism are covered by a 16 gauge stainless steel cover, 7 1/8-inches wide x 60-inches long x 5-inches high.

      2. Ceiling Plate: Equipment is fabricated from 16 gauge steel attaches to the mechanism housing and spans the shield assembly, providing stability and support for the turnstile.
3. **Rotor Assembly:** Equipment consists of 3 stainless steel rotor posts with twelve rows of stainless steel rotor arms which are welded to the front of each rotor post. Each rotor section is set at a position 120 degrees apart from one another. The top and bottom of the entire rotor assembly is held together by a flange. Each rotor section attaches to the flange using a 3/8-inches x 3-inches grade 5 fastener.

4. **Barrier:** Consists of a barrier post and eleven stainless welded arms and equally spaced at an offset to the rotor assembly.

5. **Shield Assembly:** Consists of 9 vertical stainless posts welded to 2 rolled top and bottom tubes. The radius of the shield assembly follows the rotor movement, guides patron flow and permits internal card reader cabling.

6. All components are constructed in such a manner as to eliminate all structural weaknesses.

c. **Turnstile Equipment:**

1. **Rotor Assembly:** Consists of three pieces of 2-inch square x 11-inch gauge stainless steel tubing, each known as the rotor posts.

2. **Arms:** Turnstile arms must be manufactured using 1 3/8-inch round 16 gauge stainless steel type 304 material. Each stainless steel arm has a spun closed, ground and polished end. No plastic end caps are used.

3. **Shield Assembly:** Shield must be constructed from stainless steel, with 3 vertical steel channels with ¼-inch x 1 ½-inch curved stainless steel ribs bolted to the vertical channels.

4. **Barrier Assembly:** Turnstile is designed to prevent passage in the reverse direction. It is fabricated using a 2-inch x 2-inch x 1/8-inch vertical post with the horizontal 1 3/8-inch 16 guage stainless steel type 304 arms. Each stainless steel arm has spun closed, ground and polished end.

5. **Bottom Bearing:** This equipment must be self-lubricating, waterproof and dustproof, and must consist of a thrust type bottom bearing. The bearing is on a 9-inch x 1-inch clear anodized aluminum base plate. The base plate attaches to the floor by 3 anchor bolts, 3/8-inch x 2-inches long. Bearing must have a dynamic load capacity in excess of 3200 lbs, a static load capacity of over 31,000 lbs. and a maximum rated RPM of 1700. (Anchors provided by others.)

6. **Safety:** Extra care shall be taken in desing and construction of gate to protect the user against self-inflicted injury. Surfaces shall be smooth with rounded edges, and must provide for
adequate space for comfortable movement provided in each compartment. A traffic adapter shall be built into the mechanism to prevent gate from turning after the user has passed through. Unit shall be built with heavy-gauge steel parts with large safety factor to withstand heaviest traffic and continuous service in adverse weather conditions.

d. Turnstile Security Equipment:

1. Actuation: Turnstile actuation by external card reader, biometric reader, key pad or remote push button. Actuation devices are not supplied by Boon Edam.

2. Rotation: Turnstile rotation will be anti-clockwise for entry and clockwise for exit.

3. Out-of-Service Lock Hook: Turnstile will be provided with lock hook to allow for locking against passage in both directions, when locked to keep the unit out of service. Lock provided by others.

4. Commissioning and Connectivity: Awarded civil sub-contractor will provide push button on turnstile to prove successful connectivity and installation. Once connectivity is established, civil sub-contractor will disengage push-button connectivity to allow for automation sub-contractor to provide security integration at a future date.

e. Turnstile Hardware/Materials:

1. The locking and unlocking of the turnstile is accomplished by use of low voltage, 24 VDC, system. Activation is by a momentary, isolated normally open dry contact closure.

2. Electrical controls are available in both entrance and exit directions. Controls may be fail-safe, fail-lock or any combination, in either controlled direction.

3. All fail-lock applications include a mechanical key release, which will allow free passage in case of an emergency.

4. The locking mechanism of the turnstile must be controlled via a factory-installed micro-switch. Once the user proceeds through the turnstile, the reset system automatically re-locks the turnstile and readies it for the next user. The unit allows passage on a "per-turn" basis.

5. Mandatory standard self-centering feature automatically returns rotor assembly to home position regardless of force used to pass through the turnstile.

6. The turnstile must incorporate a pulse relay, which allows one rotation per valid "go" signal regardless of the signal length.
7. The turnstile must incorporate a time-out relay, which relocks turnstile within a preset time if a person cards in and unlocks the turnstile but does not go through the unit.

8. The turnstile must include card reader mounting plates, which facilitate the seamless integration with any new or existing access control.

f. Turnstile Execution

1. Inspection: Installer must examine the location and advise the Contractor of any site conditions unacceptable for proper installation of product. These conditions include but are not limited to the following:
   a. Floor must be deal level at any point within the footprint of the turnstile.
   b. Install shall not begin until these unacceptable conditions are rectified.

2. Erection: Install turnstiles in accordance with manufacturer’s printed instructions. Set units level, plumb and with uniform hairline joints. Anchor securely into place. Use only factory trained installers.

3. Adjustment: Installer shall adjust turnstile for smooth operation and proper performance.


5. Cleaning: Clean metal carefully after installation to remove excess caulk, dirt and labels.

6. Finishes: All stainless steel components on all units are polished to a #4B satin finish, to aid in the prevention of corrosion and wear in a marine environment.

7. Available Options: time-out relay, indicator lights, electrical exit controls, heel protectors, and fail secure configuration.

5. Handicapped Gate Materials:
   b. Handicapped Gate Construction:

      1. The gate frame will consist of steel or aluminum tubing welded to a mounting flange at the base. The 24 VDC doorstrike is recess mounted into the vertical post. A one inch hole for wiring is provided through the mounting flange.
2. The gate barrier is fabricated by welding 4 sections of 2-inch square steel or aluminum tubing. Two top and bottom horizontal components are welded to the two side sections. Round steel tubing is welded to the vertical members to fill in the opening. All welds must be ground smooth.

3. A stainless steel piano hinge attaches to the gate barrier at the swing side of the frame assembly, allowing for free and easy movement of the gate barrier in one direction.

c. Handicapped Gate Equipment:

1. A frame is constructed from 2-inch square, 11 gauge steel or aluminum tubing. The frame is 86 inches high to match the turnstile.

2. The gate frame contains the 24 VDC doorstrike used to lock the gate. 24 VDC power supply not supplied unless needed for a specific application.

3. The gate barrier is constructed of 2-inch square, 11 gauge steel or aluminum tubing with round steel horizontal members. The gate barrier is 83-1/2 inches high and 34 inches wide.

4. A factory-installed hydraulic overhead closer must return the gate swing panel to the locked position after use.

d. Handicapped Gate Execution:

1. A level concrete floor is required to ensure proper installation. Recommended depth is at least 4 inches.

2. The gate is to be aligned in its proper position prior to any work beginning. A gap of 1/8 inches to 1/4 inches between the lock section of the gate frame and gate barrier is suggested. Once the gate is aligned, the 2 mounting holes at each mounting flange must be marked on the concrete surface.

3. The posts can be installed by using a minimum 3/8 inch x 3 inches wedge anchor for each mounting hole. (Annchors not included)

4. Electrical connections are made through the base of the latching post to the door strike or magnetic lock.

5. After floor mounting the gate frame needs to be braced at the top to prevent unwanted lateral movement.

6. Inspection: Installer must examine the location and advise the Contractor of any site conditions unacceptable for proper installation of product. These conditions include but are not limited to the following:
a. Floor must be dead level at any point within the footprint of the gates.

b. Install shall not begin until these unacceptable conditions are rectified.

7. Erection: Install gates in accordance with manufacturer’s printed instructions. Set units level, plumb and with uniform hairline joints. Anchor securely into place. Use only factory trained installers.

8. Adjustment: Installer will adjust hardware for smooth operation and proper performance.


10. Cleaning: Clean metal surfaces carefully after installation to remove excess caulk, dirt and labels.

11. Finishes: Finish must be #304 Stainless Steel.

12. Available Options: doorstrike (fail secure), horizontal bars, electronically open/close with timeout relay.

M. Fittings: Fittings shall be hot-dip galvanized pressed steel or wrought iron except as provided otherwise for particular components elsewhere in these Specifications. Where one of these materials is specified it shall be used.

N. Coatings: All coatings for posts, wire, gate frames, struts, rods, fittings, hinges, and latches, except as provided otherwise for a particular component elsewhere in these Specifications, shall have a minimum coating of zinc or aluminum conforming to the following ASTM Specifications:

1. A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

2. A120 - Pipe, Steel, Black or Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses.

3. A122 - Zinc-Coated (Galvanized) Steel Barbed Wire, Class 3.

4. A123 - Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.

5. A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

6. A386 - Zinc Coating (Hot-Dip) on Assembled Steel Products.

7. A392 - Zinc-Coated Steel Chain-Link Fence Fabric, Class II.

8. A491 - Aluminum-Coated Steel Chain-Link Fence Fabric, Class II.

9. A585 - Aluminum-Coated Steel Barbed Wire, Class II.
O. Touch-Up of Galvanized Surfaces:

   1. Surfaces of materials whose surfaces are damaged by handling, threading, or otherwise shall be restored to their original condition by a hot application process or shall be replaced with undamaged materials. Process used shall be the following or an approval substitution.

   2. Galvanizing compound for repairs to damaged zinc coating shall be a cold-applied compound, Galvicon as manufactured by Zenco Division, Southern Coatings and Chemical Co., Inc., Sumter, South Carolina.

   3. All applications of above coating shall be performed in accordance with Manufacturer's specifications.

P. Concrete:

   1. All posts shall be set in concrete in drilled holes. All line posts shall be set in a concrete foundation 9-inch minimum diameter and 36-inch minimum depth for "C" section posts and 40-inch depth for pipe posts, providing a minimum of 4-inch depth of concrete below pipe posts. Gate hinge posts shall be set in a concrete foundation of not less than minimum diameter and depths shown in Tabulation of Gates and Hinge Posts on the Drawings. End, corner, pull and latch posts shall be set in concrete foundations not less than 12-inch diameter and 40 inches deep, providing a minimum of 4-inch depth of concrete below bottom of pipe posts in all cases. Tops of all concrete foundations shall be crowned slightly toward center for drainage.

   2. All turnstiles shall be supplied with a concrete foundation one foot larger than the turnstile all around. The minimum thickness shall be 8 inches and the foundation shall be adequately reinforced. The top of the foundation shall be sloped to facilitate proper drainage.

   3. All concrete shall have a minimum 28-day compressive ultimate strength of 3,000 pounds per square inch. Minimum cement content shall be five (5) sacks per cubic yard and water content shall not exceed six and one-half (6-1/2) gallons of water per sack of cement.

   4. Concrete shall conform to ASTM Specifications C94, latest revision, for Ready-Mixed Concrete.

   5. Cement furnished under this contract shall be standard Portland Cement and shall conform to ASTM Specifications C150, latest revision, for Type 1 or Type 3 Portland Cement.

   6. Water used in mixing concrete shall be free from oil, acid, alkali, or organic matter.

   7. Concrete sand and coarse aggregates shall be clean, uncoated and free of any impurities except nominal amount of fine clay. Aggregates shall conform with ASTM Specifications C33, latest revision, with grading for coarse aggregate conforming to Size No. 57 (1 inch to No. 4 nominal size) in Table II of such Specification.
Q. Coating and Other Physical Requirements:

COATING REQUIREMENTS

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<thead>
<tr>
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<tbody>
<tr>
<td>1. Fabric</td>
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<td></td>
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<tr>
<td>A. Galvanized</td>
<td>1.2 Zinc</td>
<td>A392</td>
<td>I</td>
</tr>
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<td>B. Aluminum Coated</td>
<td>0.40 Aluminum</td>
<td>A491</td>
<td>II</td>
</tr>
<tr>
<td>2. Line Posts</td>
<td>1.8 Avg. Zinc</td>
<td>A120 for Pipe Post</td>
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<td></td>
<td>1.6 Zinc for 1 Specimen</td>
<td>A123 or A153 for “C” Section</td>
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<td>3. End, Corner, Pull and Gate Posts</td>
<td>1.08 Avg. Zinc</td>
<td>A120</td>
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<td>1.6 Zinc for 1 Specimen</td>
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<td>4. Extension Arms</td>
<td>2.0 Avg. Zinc</td>
<td>A123</td>
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<td></td>
<td>1.8 Zinc for 1 Specimen</td>
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<td>5. Tension Wire</td>
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<td>A. Galvanized</td>
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<td>B. Aluminum Coated</td>
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<td>6. Barbed Wire</td>
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<td>A. Galvanized</td>
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<td>B. Aluminum Coated</td>
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<td>7. Brace Pipes</td>
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<tr>
<td>8. Gate Frame</td>
<td>1.8 Avg. Zinc</td>
<td>A120</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.6 Zinc for 1 Specimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Fittings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Castings</td>
<td>2.0 Avg. Zinc</td>
<td>A153</td>
<td></td>
</tr>
<tr>
<td>B. Rolled, Pressed or Forged</td>
<td>1.8 Zinc for 1 Specimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. 3/16” thick and over</td>
<td>2.0 Avg. Zinc</td>
<td>A153</td>
<td></td>
</tr>
<tr>
<td>2. Under 3/16” thick</td>
<td>1.5 Avg. Zinc</td>
<td>A153</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.25 Zinc for 1 Specimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Bolts, Nuts &amp; Washers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Over 3/8” Dia.</td>
<td>1.25 Avg. Zinc</td>
<td>A153</td>
<td></td>
</tr>
<tr>
<td>B. 3/8” Dia. and Under</td>
<td>1.25 Avg. Zinc</td>
<td>A153</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.00 Zinc for 1 Specimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Test or Measurement Description</td>
<td>Requirement</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>1. Fabric</td>
<td>Gauge of wire</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>Breaking Strength</td>
<td>1,290 lbs.</td>
<td></td>
</tr>
<tr>
<td>2. Line Posts</td>
<td>Cross Section</td>
<td>2-3/8 inches OD</td>
<td></td>
</tr>
<tr>
<td>A. Schedule 40 Pipe</td>
<td>Min. Weight</td>
<td>3.65 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B. &quot;C&quot; Section</td>
<td>Cross Section</td>
<td>2.25 inches x 1.70 inches</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Min. Yield Strength</td>
<td>45,000 psi</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Min. Weight</td>
<td>2.64 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>3. End, Corner and Pull Posts</td>
<td>Cross Section</td>
<td>2-7/8 inches OD</td>
<td></td>
</tr>
<tr>
<td>A. Schedule 40 Pipe</td>
<td>Min. Weight</td>
<td>5.79 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Extension Arms</td>
<td>Support Weight on End</td>
<td>250 lbs.</td>
<td></td>
</tr>
<tr>
<td>5. Tension Wires</td>
<td>Gauge Wire</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td>Min. Tensile Strength</td>
<td>80,000 psi</td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Barbed Wire</td>
<td>Gauge</td>
<td>12-1/2</td>
<td></td>
</tr>
<tr>
<td>A. Wire</td>
<td></td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>B. Barbs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Brace Pipes</td>
<td>Size &amp; Min. Wt.</td>
<td>1-5/8 inches OD, 2.27 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>8. Gate Posts</td>
<td>Size &amp; Min. Wt.</td>
<td>2-7/8 inches OD, 5.79 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td></td>
<td>4 inches OD, 9.11 lbs. per ft.</td>
<td></td>
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<tr>
<td>B.</td>
<td></td>
<td>6-5/8 inches OD, 18.97 lbs. per ft.</td>
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</tr>
<tr>
<td>C.</td>
<td></td>
<td>8-5/8 inches OD, 24.70 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>D.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Gate</td>
<td>Size &amp; Min. Wt.</td>
<td>2 inches OD, 2.72 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>A. Frame Pipe</td>
<td></td>
<td>2 inches Square, 2.72 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>B. Frame Tubing</td>
<td></td>
<td>1-3/8 inches OD, 1.68 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>C. Strut Braces, Round</td>
<td></td>
<td>2 inches OD, 2.72 lbs. per ft.</td>
<td></td>
</tr>
<tr>
<td>D. Strut Braces, Square</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PART 3 EXECUTION

3.1 POSTS

A. Posts shall be set plumb to line and spaced 10-foot on centers. Gate posts shall be spaced to suit gate hinges as shown in detailed gate layouts on the Drawings. Posts shall be set in concrete foundations as specified under Paragraph Concrete, above.

B. All concrete shall be placed in dry holes. Bottoms of holes shall be solid earth in the undisturbed state, and all loose dirt and debris shall be removed prior to placing concrete.

C. Excavated soil removed from post holes shall be spread and raked out to a neat and uniform surface over existing ground along the fence line, except none of the material shall be placed in existing ditches or other drainage courses or upon road or parking area pavements or surfaced road shoulders.

3.2 FABRIC

A. Fabric shall be pulled tight and secured to line posts at intervals not exceeding 14 inches on centers and to top and bottom tension wires at intervals not exceeding 24 inches on centers. Fasten fabric at end, corner, angle, and gate posts with ¼-inch by ¾-inch hot-dip galvanized tension bar through mesh, securely strapped to posts as provided in Paragraph End, Corner and Pull Posts of these Specifications. Splices will be permitted if made with two ¼-inch by ¾-inch tension bars through mesh and strapped together.

3.3 BARBED WIRE

A. Apply three strands of barbed wire to extension arms and to pipe extensions at gate and end posts. Barbed wire shall be pulled tight between end anchorages before attachment is made to extension arms.

3.4 GENERAL

A. Fencing shall be installed by experienced fence erectors on lines established by the Port of Houston Authority. Elevation of fencing shall conform to the existing ground surface except where shown otherwise on the Drawings; however, the top line of the fence shall consist of a series of level or uniformly sloping segments of the greatest practical length between points of changing ground slope in accordance with directions furnished by the Port Construction Representative. See detailed elevations on the Drawings for certain gate and fence locations.

B. Turnstiles shall be installed in accordance with manufacturer’s instructions and in locations as shown on the Contract Drawings.

C. Turnstiles shall be anchored to the foundation according to the manufacturer’s instructions.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 91 19.00 Add - FINISH GRADING

PART 1  GENERAL

1.1  SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes:

1.  Filling and backfilling of onsite material.
2.  Subgrade preparation and spreading of topsoil
3.  Finished grading.
4.  Removal of weeds.

1.2  RELATED SECTIONS

A.  32 92 13.01 – Hydromulching

The requirements of Division 01 and general and special conditions of the contract apply to this work.

1.3  REFERENCES

A.  AASHTO M146 - Standard Specification for Terms Relating to Subgrade

1.4  MEASUREMENT AND PAYMENT

A.  Subject to Section III, no separate payment will be made for finish grading, topsoil placement or hydromulching under this Section. Include payment in lump sum item in Section 31 23 13.00.

1.5  GENERAL PROVISIONS

A.  Contractor will be required to eradicate and remove existing weed growth.

B.  Finished grading shall be defined as placing and grading of additional soil and smoothing out any rough eroded grades.

C.  Additional fill materials shall generally be defined as topsoil as specified herein unless otherwise specified.

PART 2  PRODUCTS

2.1  Fill

A.  General Qualifications: Fill shall be a clean, dry soil of a loamy character, well drained and well graded with a plasticity index not to exceed 20 or fall below 8. Fill material shall contain no oils, alkalies, acids, rubbish or other deleterious materials. The pH shall be similar to the approved topsoil.
2.2 Topsoil

A. Topsoil material that will be required for finish grading operations shall conform to the requirements included within this Section and Section 32 92 13.00.

B. General Qualifications for Topsoil:
   Imported topsoil shall be considered as material conforming to the following minimum criteria:
   1. Natural, friable, loamy soil, typical of local topsoil which produces heavy vegetative growth, free from subsoil, weeds, sods, stiff clay, stones larger than 1 inch, toxic substances, debris, or other substances which may be harmful to plant growth. Do not deliver in muddy condition.
   2. Acidity/Alkalinity: pH 6.0 to pH 7.5.

C. Grading Analysis: 2" sieve, 100% minimum passing. Number 4 sieve, 90% minimum passing. Number 10 sieve, 80% minimum passing.

   1. Sand, Silt, and Clay Content (from AASHTO M146):
      a. Sand 20 to 75 percent
      b. Silt 10 to 60 percent
      c. Clay 5 to 30 percent

   2. All topsoil shall be free from all herbicides and insecticides which might adversely affect subsequent growth of grasses or plantings or which might otherwise contain materials toxic to humans and pets.

D. Non-Conforming Material: The Contractor shall not be permitted to use imported or on-site material which does not conform to the above minimum criteria for grade operations. At the discretion of the PHA’s representative, such material can either be amended to meet the minimum requirements or shall be replaced with suitable material as specified herein.

E. It shall be the Contractor’s responsibility to verify that all topsoil conforms to these specifications.

F. Soil Analysis: The Contractor shall obtain an agricultural soil analysis of topsoil taken from three areas of the site. These samples shall be submitted to an accredited and approved soils laboratory at Contractor’s cost. Submit results of soil analysis to the PHA for review. The soil analysis shall include recommendations for amendments to the soil to produce optimum plant growth from the variety of plants and grasses proposed. These amendments shall be made at the Contractor’s expense and shall be included in the proposal.

PART 3 EXECUTION

3.1 Workmanship

A. Work shall be performed by personnel trained and experienced in this work and shall be done under the direction of a superintendent on Contractor’s staff.

3.2 Preparation Of Subgrade And Spreading Of Topsoil
A. As needed, cut back tall existing vegetation (to be removed) to a manageable height.

B. Apply post-emergent to the foliage of the existing vegetation to be removed in order to eradicate. All existing foliage and vegetation shall be eradicated.

C. Once foliage is brown, cut foliage to within 3” of grade.

D. Approximately 2 weeks later (but no more than 3 weeks), apply a second round of post-emergent to foliage.

E. The subgrade soil when at optimum soil moisture shall be scarified and loosened to a depth of 2 inches by disking or dragging and then graded to remove large ridges and depressions.

F. After the subgrade soil has been prepared, topsoil from the stockpile areas and/or imported topsoil shall be spread evenly therein to depth of 2 inches (minimum) by an approved method. No topsoil shall be spread in a muddy condition.

G. On all planting areas, the finished surface of the topsoil shall conform to the finished grade and shall be free from hollows or other inequalities, trash, debris and other extraneous matter.

3.3 Finish Grading

A. This Contractor shall be responsible for minor adjustments to the finished subgrade if such treatment is required in the opinion of the PHA’s Representative.

B. The Contractor may use machinery acceptable to the PHA’s Representative to complete most of the work to establishing finished grade.

C. To prevent excessive weed growth, the Contractor should be prepared to immediately install the tree and shrub planting and seeding upon the completed and acceptable finished grade.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 32 92 13.01 Add - HYDROMULCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes covering of any areas with healthy permanent and rooted grass system for erosion prevention and to reduce overland flow velocities. The work covered by this Item consists of furnishing all plant, labor, materials, equipment, supplies, supervision, tools, and performing all work necessary for placement of topsoil, smoothing, seeding, fertilizing, watering, maintenance, and clean-up of the site, all in accordance with the Drawings and Specifications.

B. The hydro-mulch seeding operations, together with all other sediment and erosion control measures as outlined in Technical Specifications, Section 01 57 13.00 – Temporary Erosion and Sediment Controls, shall conform to the requirements specified in this Item. The area to be hydro-mulch seeded is the entire disturbed area outside of the pavement area. Areas within the site that are not disturbed and which have a well established turf will not require seeding.

1.2 RELATED SECTIONS

A. 01 57 13.00 – Temporary Erosion and Sediment Controls

B. 32 91 19.00 – Finished Grading (Topsoil Placement)

The requirements of Division 01 and general and special conditions of this contract apply to this work.

1.3 REFERENCES

A. Texas Seed Law

B. Texas Fertilizer Law

C. Federal Seed Act

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment will be made for Hydromulching or necessary topsoil, mulching, maintenance, fertilizing, or other components described under this Section. Include payment in price of items for which Hydromulching is a component. See related section 31 23 13.00.
**1.5 SUBMITTALS**

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit certification from supplier that each type of seed conforms to these specifications and the requirements of the Texas Seed Law. Certification shall accompany seed delivery.

C. Submit a certificate stating that fertilizer complies with these specifications and the requirements of the Texas Fertilizer Law.

**PART 2 PRODUCTS**

**2.1 Materials**

A. Seeding: Seeding shall be applied within seven (7) days of the end of active disturbance of the soils surface. A proper seed bed should be prepared before seeding. Seeding on all slopes shall be done in conjunction with mulching.

B. Seed: All seed must meet the requirements of U. S. Department of Agriculture Rules and Regulations as set forth in Federal Seed Act and Texas Seed Law. Type of seed, purity and germination requirements, rate of application and planting dates are as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Pounds Application</th>
<th>Planting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hulled Common Bermuda</td>
<td>Grass 98/88</td>
<td>40 Jan 1 to</td>
</tr>
<tr>
<td>Unhulled Common Bermuda</td>
<td>Grass 98/88</td>
<td>April 15</td>
</tr>
<tr>
<td>Annual Rye Grass (Gulf)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Hulled Common Bermuda</td>
<td>Grass 98/88</td>
<td>April 15</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>to Oct. 1</td>
</tr>
<tr>
<td>Hulled Common Bermuda</td>
<td>Grass 98/88</td>
<td>Oct. 2 to</td>
</tr>
<tr>
<td>Unhulloed Common Bermuda</td>
<td>Grass 98/88</td>
<td>Jan. 1</td>
</tr>
<tr>
<td>Annual Rye Grass (Gulf)</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

C. Fertilizer: Fertilizer shall be water soluble with analysis of 10 percent nitrogen, 20 percent phosphoric acid and 10 percent potash. Rate of application shall be 750 pounds per acre except during the period of April 15 through September 1, when the rate shall be reduced to 600 pounds per acre.

D. Mulch: Mulch shall be virgin wood cellulose fiber made from whole wood chips. Within the fiber mulch material, at least 20 percent of the fibers will be 10.7 mm in length and 0.27 mm in diameter. Rate of application shall be 2,000 pounds per acre. Soil stabilizers such as Terra Type I, (or approved substitution) shall be applied at a rate of 40 pounds per acre.

E. Soil Stabilizer: “Terra Tack 1” or approved substitution. Apply uniformly at a rate of 40 pounds per acre.
F. Weed Control Agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved substitution. Apply at manufacturer's recommended rate prior to hydro-mulching.

PART 3 EXECUTION

3.1 Construction Methods

After areas to receive hydro-mulch seeding have been completed to lines, grades, and sections shown on the plans, apply seed, fertilizer and mulch at uniform average rates indicated in Paragraph 2.1, Materials of this specification.

3.2 Preparation

A. Seeding shall be applied within 7 days of the end of active disturbance of the soil surface. A proper seedbed should be prepared before seeding. Drainage from upslope areas shall be diverted around areas designated for seeding.

B. Seeding on all slopes shall be done in conjunction with mulching as indicated in the construction drawings.

C. Dispose of objectionable and waste materials in accordance with guidelines of Section 4 of the General Conditions.

3.3 Application

A. Apply uniformly all required materials to the areas designated for hydro-mulch seeding at the rates specified in Paragraph 2.1 of this specification.

B. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain the Port Construction Representative's approval before resuming operations.

3.4 Inspection

All seeding is to be inspected within 24 hours after each rainfall and daily during periods of prolonged rainfall, and at a minimum once a week. Once stabilized with grass, inspection is to be made at least once a month.

3.5 Maintenance

A. Maintain grassed areas a minimum of 90 days, or as required to establish an acceptable lawn. For areas seeded in the fall, continue maintenance the following spring until an acceptable lawn is established.

B. Maintain grassed areas by watering, fertilizing, weeding, and trimming.

C. Repair areas damaged by erosion by regrading, rolling and replanting.

D. Areas that do not have an acceptable turfing shall be reseeded. An acceptable turfing area is when at least 70 percent of the seeded area is established.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYORT TERMINAL

SECTION 32 95 10.00 Add - PAVEMENT REPAIR AND RESURFACING

PART 1  GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes repairing and resurfacing streets, highways, driveways, sidewalks, and other pavements that have been cut, broken, or otherwise damaged during construction.

1.2 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirement of the General and Special Conditions.

1.3 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for pavement repair and resurfacing under this Section. Include payment in unit price items for which pavement repair is a component.

PART 2  PRODUCTS

2.1 MATERIALS

A. Subgrade:

1. Provide backfill material as required by applicable excavation and fill sections, Sections 31 32 13.16 Cement Stabilized Sand Fill, 31 23.35.00 Excavation and Backfill for Utilities, and 31 23 23.13 Utility Backfill Materials.

2. Provide material for stabilization as required by applicable portions of Section 31 32 14.00 – Lime-Cement Stabilization of Subgrade.

B. Base: Provide base material as required by applicable portions of Section 32 11 45.00 – Drainage Layer, and 32 11 33.00 – Cement-Treated Base Course.

C. Pavement: Provide paving materials as required by applicable portions of Section 32 13 13.00- Concrete Pavement and Section 32 13 14.00 - Miscellaneous Concrete Construction.
PART 3       EXECUTION

3.1    PREPARATION

A. Conform to requirement of Section 02 41 13.13 – Removal of Existing Pavement and Structures, for removals.

B. Saw cut pavement 18 inches wider than width of trench needed to install utilities unless otherwise indicated on Drawings.

C. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, leave and protect minimum of 18 inches of undisturbed subgrade on each side of trench to support replacement slab.

3.2    INSTALLATION

A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.1, Materials.

B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings. Curbs and curbs and gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.1, Materials.

C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings. Place types and spacing of joints to match existing or as indicated on Drawings.

D. Where existing pavement consists of concrete pavement with asphaltic surfacing, resurface with minimum 2-inch depth asphaltic pavement.

E. Repair State highway crossings in accordance with TxDOT standards and within 1 week after utility work is installed.

3.3    WASTE MATERIAL DISPOSAL

A. Dispose of waste material in accordance with requirements of Section 4 of the General Conditions.

3.4    PROTECTION

A. Maintain pavement in good condition until completion of the Work.

B. Replace damaged pavement.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 05 15.00 Add – PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines.

B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes are specifically indicated in Drawings.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

A. Payment will be made for Precast Concrete Manholes under this Section for Each manhole provided and installed. Payment shall include furnishing all labor; all materials, including concrete, mortar and brickwork; pumping, excavation, hauling, and disposal of surplus earth; backfilling and tamping; connection of leads, stubs and sewer lines to the manhole; manhole PVC lining and all other incidentals necessary to complete the manhole. No separate payment shall be made for manhole frames and covers, which items shall be considered incidental to the manhole.

2.03 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings

B. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. ASTM C 270 - Standard Specification for Mortar for Unit Masonry


F. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

G. ASTM C 923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

I. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft)


K. ASTM D 2996 - Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

L. ASTM D 2997 - Standard Specification for Centrifugally Cast “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe


O. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

P. American Association of State Highway and Transportation Officials (AASHTO)

1.04 SUBMITTALS

A. Submit manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.

2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.

3. Frames, grates, rings, and covers

4. Materials to be used in fabricating drop connections

5. Materials to be used for pipe connections at manhole walls

6. Materials to be used for stubs and stub plugs, if required

7. Materials and procedures for corrosion-resistant liner and coatings, if required.

8. Plugs to be used for sanitary sewer hydrostatic testing

9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches

C. Seal submittal drawings by Professional Engineer registered in State of Texas.
PART 2 PRODUCTS

2.01 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478 and the design loading criteria identified below. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 9 inches. Base section shall have minimum thickness of 12 inches under invert.

C. Provide frames and tops to support airport rated loadings as indicated on Drawings.

D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Project Manager.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.

1. The complete Manhole shall be rated for airport rated loadings (min. 100,000 lbs)

2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections

3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf

4. Internal liquid pressure based on unit weight of 63 pcf

5. Dead load of manhole sections fully supported by transition and base slabs

F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:

1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.

2. Wall loading conditions:
a. Saturated soil pressure acting on empty manhole
b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure

3. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater

G. Provide joints between sections with o-ring gaskets conforming to ASTM C 443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6 inches above inside surface of floor of base.

2.02 CONCRETE

A. Conform to requirements of Section 32 13 15.00 - Concrete for Utility Construction.

B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4000 psi.

C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings, conforming to requirements of Section 31 32 13.16 - Cement Stabilized Sand.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4000 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.03 REINFORCING STEEL

A. Conform to requirements of Section 32 13 15.00 - Concrete for Utility Construction.

2.04 MORTAR

A. Conform to requirements of Section 04 0500 - Mortar.

2.05 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Section 33 08 40.00 – Frames, Grates, Rings and Covers.

2.06 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.07 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers

1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:
a. External clamps: Type 304 stainless steel
b. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.
c. Internal, expandable clamps on corrosion-resistant manholes:
   1) Type 316 stainless steel, 11 gauge minimum
   2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

B. Storm Sewer Connections:

1. Provide watertight connections in accordance with ASTM C 923 and ASTM F 2510 as applicable.

C. Water Lines

1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel -up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.08 SEALANT MATERIALS

A. Approved products in accordance with Section 01 6000 - Product Substitution Procedures.

B. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultrasleal P201, or approved equal.

C. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

D. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.
2.09 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on Drawings, provide one of following:

1. PVC liner for precast cylindrical manhole section, base sections, and cone sections in accordance with Section 33 42 70.00 - Plastic Liner for Large-Diameter Concrete Sewers and Structures.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Section 31 23 35.00 - Excavation and Backfill for Utilities.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

2.12 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer’s recommendations.

2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive.

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125- pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.

4. Coating: Provide approved 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Color shall be selected by Project Manager from manufacturer’s standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of sanitary sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

2.14 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings:
1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.
2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.
3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

B. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3  EXECUTION

3.01  EXAMINATION

A. Verify that lines and grades are correct.
B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treats as unstable subgrade.
C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

3.02  PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on Drawings.
B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.03  MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 12 inch thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Section 3 13.16 - Cement Stabilized Sand.
B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

3.04  PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer’s printed recommendations.
B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer’s recommendations.

E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting.

3.05 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer’s instructions.

1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight Assemblies: “Press-Wedge,” “Res-Seal,” “Thunderline Link-Seals,” or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

E. Test connection for watertight seal before backfilling.

3.06 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum

2. Depth of bench to invert:
   a. Pipes smaller than 15 inches: one-half of largest pipe diameter
b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter

c. Pipes larger than 24 inches: equal to largest pipe diameter

3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.07 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of 4 inches outside bells.

B. Install drop connection when sewer line enters manhole higher than 24 inches above invert of manhole.

3.08 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.09 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.
3.10 BACKFILL
A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 31 23 35.00 - Excavation and Backfill for Utilities. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12 inches over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.

3.11 FIELD QUALITY CONTROL
A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Section 33 31 00.00 - Acceptance Testing for Sanitary Sewers.

3.12 PROTECTION
A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to City.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 08 40.00 Add - FRAMES, GRATES, RINGS, AND COVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this section includes:

1. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.
2. Ring grates.

1.2 RELATED SECTIONS

The requirements of Division 01 and general and special conditions of this contract apply to this work.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO).
   2. ASTM A536 – Standard Specification for Ductile Iron Castings
   3. ASTM A 615 - Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement.
C. American Welding Society (AWS).
   1. AWS – 11.2 Welding Iron Castings.

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, no separate payment shall be made for work under this Section. Include cost of frames, grates, rings, covers, and seals in the unit price of associated items which these items are a component.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.
C. Submit shop drawings for fabrication and installation of casting assemblies. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 PRODUCTS

2.1 Castings
   A. Castings for frames, grates, rings and covers shall conform to ASTM A 48, Class 35B or ASTM A536. Provide locking covers if indicated on Drawings.
   B. Castings shall be capable of withstanding the application of an aircraft loading (250 psi and 100,000 lb total load) without permanent deformation.
   C. Fabricate castings to conform to the shapes, dimensions, and with wording matching the use of the utilities within the manhole; all manholes shall also have the working “Confined Space”. Standard dimensions for manhole covers are 30 inches diameter opening for sanitary, 24 inches diameter opening for storm sewer, and 38 inches in diameter for power and communication.
   D. Castings shall be clean, free from blowholes and other surface imperfections. Cast holes in covers shall be clean and symmetrical, free of plugs.

2.2 Bearing Surfaces
   Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for any position in which the casting may be seated in the frame.

2.3 Special Frames And Covers
   Where indicated on the Drawings, provide watertight manhole frames and covers with a minimum of four bolts and a gasket designed to seal cover to frame.

2.4 Finish
   Unless otherwise specified, coat iron castings to be finished in accordance with the manufacturer's recommended finish.

2.5 Fabricated Ring Grates
   A. Ring grates shall be fabricated from reinforcing steel conforming to ASTM A 615.
   B. Welds connecting the bars shall conform to AWS 11.2.

PART 3 EXECUTION

3.1 Installation
   A. Install castings according to approved shop drawings, instructions given in related specifications, and applicable directions from the manufacturer's printed materials.
   B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in formwork until permanently set.
C. Ring grates shall be fabricated in accordance with the Port of Houston Authority standard detail, Ring Grate for Open End of 18" to 72" Stubs to Ditch, and shall be set in mortar in the mouth of the pipe bell.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 11 13.01 Add – WATER MAINS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes:

1. Installation of potable water mains.

2. Installation of firewater main branches.

B. Specifications identify requirements for both small-diameter water mains and large-diameter water mains (water mains 30 inches in diameter and larger). When specifications for large-diameter water mains differ from those for small-diameter water mains, large-diameter specifications will govern for large-diameter pipe.

1.2 RELATED SECTIONS:

Section 31 23 23.13 - Utility Backfill Materials

Section 31 23 35.00 - Excavation and Backfill for Utilities

Section 32 13 15.00 - Concrete for Utility Construction

Section 33 11 13.04 - Fire Hydrants

Section 33 11 15.00 - Polyvinyl Chloride Pipe and Fittings

Section 33 11 51.00 - Polyethylene Wrap

Section 33 11 52.00 - Valve Boxes, Meter Boxes and Meter Vaults

Section 33 11 53.00 - Gate Valves

Section 33 14 00.00 - Hydrostatic Testing of Pipelines

Section 33 42 70.00 - Plastic Liner for Large Diameter Concrete Sewers and Structures

Section 33 50 10.00 - Ductile Iron Pipe and Fittings

Section 33 51 40.00 - Disinfection of Water lines
1.3 REFERENCES

A. American National Standards Institute (ANSI).

   1. ASTM B 21 - Specification for Naval Brass Rod, Bar, and Shapes.
   2. ASTM B 98 - Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
   7. ASTM F 477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association (AWWA).
   1. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

1.4 MEASUREMENT AND PAYMENT

A. Water mains installed by open-cut or augered with or without casing shall be paid on a linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation.
   1. Mains: Measure along axis of pipe and include fittings and valves.
   2. Branches: Measure from axis of water line to end of branch.

B. For large-diameter water mains, payment for an interconnection is on a lump sum basis for each interconnection identified on the drawings. Payment will include tapping sleeve and valves, connections and all other related work necessary for construction as shown on Drawings and as specified.

   No separate payment shall be made for interconnections, sleeves, valves or other related work for pipe less than 30 inches in diameter.

C. For large-diameter water mains, payment for removal of existing internal elliptical or dished head plug is for each existing internal elliptical or dished head plug removed. Payment will include deletion of plug, drainage or dewatering of water lines, repair of damaged linings, rechlorination and all items incidental to operation.
No separate payment shall be made for plugs, drainage or dewatering, chlorination, testing, linings, or other related work for pipe less than 30 inches in diameter.

D. Photography required under this Section shall be incidental to Section 01 33 32.00 – Construction Photos.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Conform to submittal requirements of applicable Section for type of pipe used.

C. Photographs: Prior to commencement of construction, take 35mm color photographs of entire route of project and present one copy of prints and negatives to the Port Construction Representative. Required items in photographs include, but are not limited to, the following:

1. Date fixed on negative by calendared attachment in camera (automatically includes date on film).

2. Location of photograph, streets, and direction of view.

3. Photographs shall indicate existing condition of property including curbs, sidewalks, trees and other major features within the area to be disturbed.

4. Take sufficient number of photographs to show existence or nonexistence of cracked concrete, trees, shrubs, and grass. Bind photographs in 3-ring notebook within plastic pockets.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Install pipe materials which conform to following:

1. Section 33 50 10.00 - Ductile Iron Pipe and Fittings.

2. Section 33 11 15.00 - Polyvinyl Chloride Pipe.

B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.

2.2 RESTRAINED JOINTS

A. Ductile-Iron Pipe:


2. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.

3. TR-Flex or Field-Lok Joint by U.S. Pipe and Foundry Company.

B. PVC Pipe:
1. Fittings: JCM 610 Sur-Grip Fitting Restrainer by JCM Industries, Inc. or Series 500 Fitting restrainer by Ebba Iron, Inc., or approved substitute.

2. Bell and Spigot: JCM or 621 Sur-Grip Bell Joint restrainer by JCM Industries, Inc. or Series 1500 or Series 1100HV Joint Restrainer by Ebba Iron, Inc., or approved substitute.

PART 3  EXECUTION

3.1  PREPARATION

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints. Lay pipe with bell ends facing in direction of laying.

C. Lay pipe to lines and grades shown on Drawings. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 50 feet on record drawings.

D. Confirm that separation from gravity sanitary sewers and manholes or from force mains have the minimum clearance as specified in this Section or 9 feet in all directions unless a special design is provided on the Drawings:

   1. Parallel water line and gravity sanitary sewer, force main or manhole with no leaks: Minimum 4 foot horizontal clearance from outside wall of water line to outside wall of gravity sanitary sewer, force main, or manhole.

   2. Water line crossing above a gravity sanitary sewer or force main with no leaks: Minimum 2 foot vertical clearance.

E. Where above clearances cannot be attained, and a special design has not been provided on Drawings, obtain direction from the Port Construction Representative before proceeding with construction.

F. Inform the Port Construction Representative if any unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by the Port Construction Representative.

G. Keep pipe trenches free of water which might impair pipe laying operations. Prevent pipe bells from coming in contact with subgrade. Grade pipe trenches to provide uniform support along bottom of pipe. Excavate for bell holes for proper sealing of pipe joints after bottom has been graded and in advance of placing pipe. Lay not more than a nominal city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

H. The Contractor is responsible for coordinating operations involving opening and closing valves for wet connections and for chlorination with the proper City of Pasadena officials.
Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.

I. If asbestos-cement pipe is encountered, follow safety practices outlined in the Asbestos-Cement Pipe Producers Association publication, Recommended Work Practices for A/C Pipe. Strictly adhere to recommended practices contained in this publication.

J. Contractor is responsible for assuring the chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for all costs due to downtime if requirements are not met.

### 3.2 HANDLING, CLEANING AND INSPECTION

#### A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.

2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.

4. Use precautions to prevent injury to pipe, protective linings and coatings.
   a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
   b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
   c. Do not lift pipe using hooks at each end of pipe.
   d. Do not place debris, tools, clothing, or other materials on pipe.

5. Repair damage to pipe or protective lining and coating before final acceptance.

6. Permit no visible cracks longer than 6 inches, measured within 15 degrees of a line parallel to pipe longitudinal axis in the cores of finished pipe with the following exceptions:
   a. In the surface laitance of centrifugally cast concrete.
   b. In sections of pipe with steel reinforcing collars or wrappers.
   c. Within 12 inches of pipe ends.

7. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.
B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until the Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.3 EARTHWORK

A. Conform to applicable provisions of Section 31 23 35.00 - Excavation and Backfill for Utilities.


C. Backfill: Use bank run sand or earth or native soil as specified in Section 31 23 23.13 - Utility Backfill Materials. Backfill excavated areas in the same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Field density tests may be made at a frequency determined by the Port Construction Representative. Water tamping is not allowed.

E. Pipe Zone: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.4 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the Port Construction Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.5 PIPING INSTALLATION

A. Do not lay pipe unless subgrade is free of water. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material. Wedging or blocking up bell will not be acceptable.

B. Do not install pipe at greater depth than its design allows.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

3.6 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints (Ductile Iron Pipe, PVC):

1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.

3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.

4. After the pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.

B. Flanged Joints (Ductile Iron Pipe):

1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.

2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at the factory to proper dimensions.

3. Use galvanized or black nuts and bolts to match flange material. Use cadmium-plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.

C. Joint Testing:

1. In addition to testing individual joints with feeler gauge approximately 1/2-inch wide and 0.015-inch thick, use any other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. These tests shall be made at no additional cost to the Port of Houston Authority.

2. Test 100 percent of welded joints including any joint or seam welded after successful hydrostatic testing by methods as described above. The Port of Houston Authority reserves right to require additional tests if tests performed indicate an unacceptable weld. Repair rejected weld.

D. Quality Inspection: Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by the Port Construction Representative. Contractor may submit details of other methods of providing curves and bends for consideration by the Port Construction Representative, and if accepted, shall be installed at no additional cost to the Port of Houston Authority.

1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.

2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.

3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.

4. Replace, repair, or reapply coatings and linings as required.
5. Assessment of deflection may be measured by the Port Construction Representative at any location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.

6. When rubber gasketed pipe is laid on a curve, join pipe in a straight alignment and then deflect to curved alignment.

7. Fill exposed interior and exterior surfaces with nonshrink grout.

3.7 SECURING, SUPPORTING AND ANCHORING

A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water main by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begin upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.8 THRUST RESTRAINT

A. Prevent any lateral movement of thrust restraints throughout pressure testing and operation. Place 2500 psi concrete conforming to Section 32 13 15.00 - Concrete for Utility Construction, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.

B. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of prestressed concrete cylinder pipe. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer for review by the Port Construction Representative. Make adjustments in thrust restraint lengths at no additional cost to the Port of Houston Authority.

C. Passive resistance of soil will not be permitted in calculation of thrust restraint.

D. Use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide welded restraint joints for a minimum length of 16 feet on each side of beveled joints.
3.9 POLYETHYLENE WRAP
A. Double wrap ductile iron pipe and appurtenances (except fire hydrants) with 8-mil polyethylene film.
B. Conform to requirements of Section 33 11 51.00 - Polyethylene Wrap.

3.10 CLEANUP AND RESTORATION
A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during chlorination, testing, service transfers, abandonment of old mains, backfill and surface restoration.
B. Upon completion of section not exceeding 4000 feet per crew, chlorinate and pressure test. Begin transfer of services no later than 7 calendar days after successful completion of chlorination and pressure testing.
C. After transfer of services, but no later than 21 calendar days after successful completion of chlorination and pressure testing, begin abandonment of old mains, including resodding and placement of sidewalks and pavements.
D. Do not begin construction of additional sections if above conditions are not met.

3.11 CLEANING PIPING SYSTEMS
A. Remove construction debris or foreign material and thoroughly clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning.

3.12 DISINFECTION OF WATER LINES
A. Conform to requirements of Section 33 51 40.00 - Disinfection of Water lines.

3.13 FIELD HYDROSTATIC TESTS
A. Conform to requirements of Section 33 14 00.00 - Hydrostatic Testing of Pipelines.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes fire hydrants.

1.2 RELATED SECTIONS

Section 33 11 13.01 - Water Mains

Section 33 11 52.00 – Valve Boxes, Meter boxes and Meter Vaults

Section 33 50 10.00 - Ductile-Iron Pipe and Fittings

1.3 MEASUREMENT AND PAYMENT

A. Fire Hydrants shall be paid for each fire hydrant assembly, including 6-inch gate valve and box, installed regardless of depth.

B. Fire Hydrant Branches (leads) shall be paid on a linear foot basis for each branch installed. Separate pay items are used for open-cut and augered branches. Measurement of branches is as defined in Section 33 11 13.01.

1.4 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number of hydrant proposed for use.

1.5 HANDLING AND STORAGE

A. Handling and storage shall be according to the material manufacturer’s recommendations.

PART 2 PRODUCTS

2.1 HYDRANTS

A. The following fire hydrants have been approved. Alternate fire hydrants will not be considered.
### HYDRANT ENGINEERING CONTROL DRAWING

<table>
<thead>
<tr>
<th>HYDRANT</th>
<th>ENGINEERING CONTROL DRAWING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centurion A423 Option 110</td>
<td>FH-70 Rev. A dated 03/06/97</td>
</tr>
<tr>
<td>(Super Centurion 250)</td>
<td></td>
</tr>
<tr>
<td>Metropolitan 250</td>
<td>960324 Rev. A dated 02/25/97</td>
</tr>
<tr>
<td>Clow - 5 1/4&quot; Medallion</td>
<td>D-20454 Rev. F dated 02/97</td>
</tr>
<tr>
<td></td>
<td>D-20455 Rev. dated 02/97</td>
</tr>
<tr>
<td>American Darling B84B</td>
<td>94-20052 Rev. A dated 03/01/95 and 94-20051 dated 10/26/95 or 91-20048 dated 10/26/94</td>
</tr>
<tr>
<td>Waterous - Pacer WB67HOU</td>
<td>HPL81408 and PR1511 dated 11/21/94</td>
</tr>
<tr>
<td></td>
<td>HPL81408-1 and PR1511-A dated 11/21/94</td>
</tr>
<tr>
<td>Kennedy - Guardian K81A</td>
<td>81257 Rev. 2 dated 01/97</td>
</tr>
</tbody>
</table>

B. The Port Construction Representative may, at any time prior to or during installation of hydrants, randomly select a furnished hydrant for disassembly and laboratory inspection, to verify compliance with Specifications. If such hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place a 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.
B. Locate nozzle center line minimum 18 inches above finish grade.

C. Place 12-inch x 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by the Port Construction Representative) on pumper nozzles of new or relocated fire hydrants installed on new mains not in service. Remove indicators after new main is tested and approved by the Port Construction Representative.

D. Do not cover drain ports when placing concrete thrust block.

E. Obtain the Port Construction Representative’s approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water main flow line or fire hydrant barrel length caused by such obstructions.

F. Install branches (leads) in accordance with Section 33 11 13.01 - Water Mains.

G. Coating Requirements:
   1. Apply coatings in strict accordance with manufacturer’s recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.
   2. Furnish an affidavit of compliance that coatings furnished complies with requirements of this specification and referenced standards, as applicable.

H. Use following color code for field coating of hydrant bonnet to indicate size of water main supplying hydrant:

<table>
<thead>
<tr>
<th>Supply Main Diameter (inches)</th>
<th>Bonnet Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Yellow</td>
</tr>
<tr>
<td>8</td>
<td>White</td>
</tr>
<tr>
<td>12-20</td>
<td>Green</td>
</tr>
<tr>
<td>24 and larger</td>
<td>Orange</td>
</tr>
</tbody>
</table>

I. Remove and dispose of unsuitable materials and debris in accordance with requirements in Section 4 of the General Conditions.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 11 15.00 Add – POLYVINYL CHLORIDE PIPE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes:

1. Polyvinyl chloride pressure pipe for water distribution in nominal diameters 4 inches through 12 inches.

2. Polyvinyl chloride sewer pipe for gravity sanitary sewers in nominal diameters 4 inches through 15 inches.

3. Polyvinyl chloride pressure pipe for gravity sanitary sewers and force mains in nominal diameters 4 inches through 12 inches.

1.2 RELATED SECTIONS

Section 31 23 35.00 - Excavation and Backfill

Section 33 11 13.01 - Water Mains

Section 33 14 00.00 – Hydrostatic Testing of Pipelines

Section 33 30 00.00 – General Sanitary Sewers

Section 33 34 00.00 - Sanitary Utility Sewerage Force Mains

Section 33 50 10.00 – Ductile – Iron Pipe and Fittings

1.3 REFERENCES

A. American Society of Testing Materials (ASTM)


CSP Date: April 1, 2014

33 11 15.00 Add

POLYVINYL CHLORIDE PIPE

Page - 1
4. ASTM D 2321 - Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
5. ASTM D 2444 - Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
6. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Polyvinyl Chloride Composite Sewer Piping.
7. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride Sewer Pipe and Fittings.

B. American Water Works Association (AWWA)
1. AWWA C 900 – Polyvinyl Chloride Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution

C. Plastic Pipe Institute’s Technical Report (PPITR)

1.4 MEASUREMENT AND PAYMENT
A. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for work included as specified in the following sections:
1. Section 33 11 13.01 - Water Mains
2. Section 33 30 00.00 – General Sanitary Sewers
3. Section 33 34 00.00 – Sanitary Utility Sewerage Force Mains
4. Section 33 40 00.00 – Storm Drainage Utilities

1.5 SUBMITTALS
A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.
1.6 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900 or AWWA C 905 for pressure pipe applications, or the appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe has been hydrostatically tested at the factory in accordance with AWWA C 900 or AWWA C 905 and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States. Certification from any other source is not acceptable. Furnish copies of test reports to the Port Construction Representative for review. Cost of testing shall be borne by Contractor.

PART 2 PRODUCTS

2.1 MATERIAL

A. Use PVC compounds in the manufacture of pipe that contain no ingredient in an amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for a rating of 4000 psi for water at 73.4 degrees F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. For PVC pressure pipe used for water mains, provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.

D. Gaskets:

1. Gaskets shall meet the requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.

2. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket materials for the noted contaminants.

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other contaminants</td>
<td>As recommended by the pipe manufacturer</td>
</tr>
</tbody>
</table>
3. Do not use PVC gasket material for water mains in potentially contaminated areas.

E. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

F. PVC pipe for water service shall bear National Sanitation Foundation Seal of approval (NSF-PW).

2.2 WATER SERVICE PIPE

A. Pipe 4-inch through 12-inch: AWWA C 900, Class 150, DR 18; nominal 20-foot lengths; cast iron equivalent outside diameters.

B. Joints: ASTM D 3139; push-on type joints in integral bell or separate sleeve couplings. Do not use socket type or solvent weld type joints.

C. Make curves and bends by deflecting the joints. Do not exceed maximum deflection recommended by the pipe manufacturer. Submit details of other methods of providing curves and bends for review by the Port Construction Representative.

D. Hydrostatic Tests: AWWA C 900, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer’s written certification.

2.3 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fitting: ANSI A 21.10, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating.

B. Coatings and Linings: Conform to requirements of Section 33 50 10.00 – Ductile – Iron Pipe and Fittings.

2.4 GRAVITY SANITARY SEWER PIPE

A. PVC gravity sanitary sewer pipe shall be in accordance with the provisions in the following table:
### WALL CONSTRUCTION MANUFACTURER OPTIONS ASTM DESIGNATION SDR (MAX.)/STIFFNESS (MIN.) DIAMETER SIZE RANGE

<table>
<thead>
<tr>
<th>WALL CONSTRUCTION</th>
<th>MANUFACTURER</th>
<th>PRODUCT OPTIONS</th>
<th>ASTM DESIGNATION</th>
<th>SDR (MAX.)/STIFFNESS (MIN.)</th>
<th>DIAMETER SIZE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>J-M Pipe</td>
<td>Approved</td>
<td>D3034</td>
<td>SDR 26 / PS 115</td>
<td>6&quot; to 12&quot;</td>
</tr>
<tr>
<td></td>
<td>CertainTeed</td>
<td>Approved</td>
<td>D3034</td>
<td>SDR 35 / PS 46</td>
<td>12&quot; &amp; 15&quot;</td>
</tr>
<tr>
<td></td>
<td>Can-Tex</td>
<td>Approved</td>
<td>AWWA C900</td>
<td>DR 18 / N/A</td>
<td>4&quot; to 12&quot;</td>
</tr>
<tr>
<td></td>
<td>Carlon</td>
<td>Approved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diamond</td>
<td>Approved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Truss (Gasketed)</td>
<td>Contech</td>
<td>Preapproved</td>
<td>D2680</td>
<td>N/A /200 psi</td>
<td>8&quot; to 15&quot;</td>
</tr>
</tbody>
</table>

B. For sewers up to 12-inch-diameter crossing over waterlines, or crossing under waterlines with less than 2 feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

C. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. The manufacturer shall test a sample from each batch conforming to requirements ASTM D 2444.

D. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

### SANITARY SEWER FORCE MAIN PIPE

A. Provide PVC pressure pipe conforming to the requirements for water service pipe, and conforming to the minimum working pressure rating specified in Section 33 34 00.00 - Sanitary Utility Sewerage Force Mains.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting the requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use EBAA Iron Series 2000PV, Uniflange Series 1350 restrainer, or approved substitution joint restraint device conforming to ASTM F 1674, for PVC pipe 12-inch diameter and less.

C. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Section 33 14 00.00 – Hydrostatic Testing of Pipelines.
D. Manufacturers: Approved manufacturers of pressure rated, solid wall PVC pipe for sanitary sewer force mains are:

2. CertainTeed Corporation
3. Diamond Plastics Corporation
4. Carlon Company

PART 3 EXECUTION

3.1 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with the manufacturer's recommendations.

3.2 INSTALLATION

A. Conform to requirements of Section 33 11 13.01 - Water Mains, Section 33 30 00.00 – General Sanitary Sewers, and Section 33 34 00.00 - Sanitary Utility Sewerage Force Mains, as applicable.

B. Install PVC pipe in accordance with Section 31 23 35.00 - Excavation and Backfill for Utilities, ASTM D 2321, and manufacturer's recommendations.

C. Water service pipe 12 inches in diameter and smaller: Installed to clear utility lines and have minimum 4 feet of cover below lowest property line grade of street, unless otherwise required by Drawings.

D. For water service, exclude use of PVC within 200 feet (along the public right-of-way) of underground storage tanks or in undeveloped commercial acreage. Underground storage tanks are primarily located on service stations but can exist at other commercial establishments.

E. Avoid imposing strains that will overstress or buckle the pipe when lowering pipe into trench.

F. Hand shovel pipe bedding under the pipe haunches and along the sides of the pipe barrel and compact to eliminate voids and ensure side support.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes:

1. High Density Polyethylene (HDPE) pipe for gravity sewers and drains, including fittings.
2. HDPE pipe for sanitary sewer force mains, including fittings.

1.2 REFERENCES


F. ASTM F 477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

G. ASTM F 714 - Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

H. ASTM F 894 - Specification for Polyethylene Plastic (PE) Large-diameter Profile Wall Sewer and Drain Pipe.

1.3 MEASUREMENT AND PAYMENT

A. No separate payment will be made HDPE Solid and Profile Wall Pipe under this Section. Include cost in unit price for work included as specified in the following sections:

1. Section 33 30 00.00 – General Sanitary Sewers
2. Section 33 34 00.00 – Sanitary Utility Sewerage Force Mains
3. Section 33 40 00.00 – Storm Drainage Utilities

1.4 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit shop drawings showing design of pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.5 QUALITY CONTROL

A. Provide the manufacturer’s certificate of conformance to the Specifications.

PART 2 PRODUCTS

2.1 APPROVED AND PREAPPROVED PRODUCTS

A. Provide HDPE pipe as follows:

<table>
<thead>
<tr>
<th>WALL CONSTRUCTION</th>
<th>MANUFACTURER</th>
<th>PRODUCT OPTIONS</th>
<th>ASTM DESIGNATION</th>
<th>PIPE STIFFNESS (MIN)</th>
<th>DIAMETER (INCHES)</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Wall</td>
<td>Drisco 1000</td>
<td>Approved</td>
<td>F714</td>
<td>115 psi</td>
<td>8 to 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drisco 8600</td>
<td></td>
<td></td>
<td>46 psi</td>
<td>12 to 48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quali Pipe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poly Pipe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plexco</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profile Wall</td>
<td>Spirolite</td>
<td>Pre-approved</td>
<td>F894</td>
<td>46 psi</td>
<td>18 to 120</td>
<td></td>
</tr>
</tbody>
</table>

B. Solid wall pipe shall be produced with plain end construction for heat Joining (butt fusion) conforming to ASTM D 2657. Utilize controlled temperatures and pressures for joining to produce a fused leak-free joint.

C. Furnish profile-wall gravity sewer pipe with bell-and-spigot end construction conforming to ASTM D 3212. Joining will be accomplished with an elastomeric gasket in accordance with the manufacturer’s recommendations. Use integral bell-and-spigot gasketed joint designed so that when assembled, the elastomeric gasket, contained in a machined groove on the pipe spigot, is compressed radially in the pipe bell to form a positive seal. Also have joint designed to avoid displacement of the gasket when installed in accordance with the manufacturer’s recommendations.

D. For solid wall pipe for sanitary sewer force mains, provide pipe with a minimum working pressure rating of 150 psi, and with an inside diameter equal to or greater than the nominal pipe size indicated on the Drawings.

E. HDPE pipe is not approved in applications requiring augering of sewer pipe.
2.2 MATERIALS

A. Pipe and Fittings: High density, high molecular weight polyethylene pipe material meeting the requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248. Material meeting the requirements of cell classification in accordance with ASTM D 3350 are also suitable for making pipe products under these specifications.

B. Other Pipe Materials: Materials other than those specified in Paragraph 2.2A, Pipe and Fittings, may be used as part of the profile construction, e.g., as a core tube to support the shape of the profile during processing, provided that these materials are compatible with the base polyethylene material and are completely encapsulated in the finished product and in no way compromise the performance of the pipe products in the intended use. Examples of suitable material include polyethylene and polypropylene.

C. Gaskets.

1. Use gaskets meeting requirement of ASTM F 477. Use gasket molded into a circular form or extruded to the proper section and then spliced into circular form. When no contaminant is identified, use gaskets of a properly cured, high-grade elastomeric compound. The basic polymer shall be natural rubber, synthetic elastomer, or a blend of both.

2. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket materials for the noted contaminants:

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other Contaminants</td>
<td>As recommended by the pipe manufacturer</td>
</tr>
</tbody>
</table>

D. Lubricant. Use a lubricant for assembly of gasketed joints which has no detrimental effect on the gasket or on the pipe, in accordance with manufacturer's recommendations.

2.3 WORKMANSHIP

A. Furnish pipe and fittings that are homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Provide pipe as uniform as commercially practical in color, opacity, density, and other physical properties.

2.4 INSPECTIONS

A. The Port Construction Representative reserves the right to inspect pipes or witness pipe manufacturing. Such inspection shall in no way relieve the manufacturer of the responsibilities to provide products that comply with the applicable standards and these Specifications.
B. Manufacturer's Notification: Should the Port Construction Representative wish to witness the manufacture of specific pipes, the manufacturer shall provide the Port Construction Representative with adequate advance notice of when and where the production of those specific pipes will take place.

C. Failure to Inspect. Approval of the products or tests is not implied by the Port Construction Representative's decision not to inspect the manufacturing, testing, or finished pipes.

2.5 TEST METHODS

A. Conditioning. Conditioning of samples prior to and during tests are subject to approval by the Port Construction Representative. When referee tests are required, condition the specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under the same conditions of temperature and humidity unless otherwise specified.

B. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.5A, in a suitable press until the internal diameter has been reduced to 40 percent of the original inside diameter of the pipe. The rate of loading shall be uniform and at 2-inches per minute. The test specimens, when examined under normal light and with the unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of the pipe walls or bracing profiles.

C. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except replace the shear load transfer bars and supports with 6-inch-wide support blocks that can be either flat or contoured to conform to the pipe's outer contour.

D. Purpose of Tests. The flattening and the joint tightness tests are not intended to be routine quality control tests, but rather to qualify pipe to a specified level of performance.

2.6 MARKING

A. Mark each standard and random length of pipe in compliance with these Specifications with the following information:

1. Pipe size
2. Pipe class
3. Production code
4. Material designation
PART 3 EXECUTION

3.1 INSTALLATION

A. Conform to requirements of the following Sections:

1. Section 33 30 00.00 – General Sanitary Sewers
2. Section 33 34 00.00 - Sanitary Utility Sewerage Force Mains

B. Install pipe in accordance with the manufacturer’s recommended installation procedures.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 11 51.00 Add – POLYETHYLENE WRAP

PART 1  GENERAL

1.1  SECTION INCLUDES

Subject to the General and Special Conditions, this section includes polyethylene wrap to be used in open-cut construction for ductile iron pipe when cathodic protection system is not required by Drawings.

1.2  REFERENCES

A. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.
B. AWWA C 105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.

1.3  MEASUREMENT AND PAYMENT

A. No separate payment will be made for polyethylene wrap. Include cost of polyethylene wrap in unit price for pipes and fittings to be wrapped.

1.4  SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Submit product data for proposed film and tape for approval.

1.5  HANDLING AND STORAGE

A. Handling and storage shall be according to the material manufacturer’s recommendations.

PART 2  PRODUCTS

2.1  MATERIALS:

A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays, or defects; conforming with requirements of AWWA C 105, 2.5 to 3 percent carbon black content, either low- or high-density:

1. High-Density, Cross-Laminated Polyethylene Film: High-density, cross laminated polyethylene film shall be manufactured of virgin polyethylene material conforming to the following requirements of ASTM D 1248
a. Raw Material.
   1) Type: III.
   2) Class: C (black).
   3) Grade: P33.
   4) Flow rate (formerly melt index): 0.4 to 0.5g/10 minute, maximum.
   5) Dielectric strength: Volume resistivity, $10^{15}$ ohm-cm, minimum.

b. Physical Properties:
   1) Tensile strength: 5000 psi, minimum.
   2) Elongation: 100 percent, minimum.
   3) Dielectric strength: 800 V/mil thickness, minimum.

c. Thickness: Film shall have a nominal thickness of 0.004 inch. The minus tolerance of thickness is 10 percent of the nominal thickness.

B. Polyethylene Tape: Provide 3-inch-wide, plastic-backed, adhesive tape; Paleocene No. 900, Scotchwrap No. 50, or approved substitution.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fit polyethylene film to contour of pipe to effect a snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

3.2 INSTALLATION

A. Tubular Type:
   1. Cut polyethylene tube to a length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.
2. Before making up joint, slip 3-foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3-foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

B. Sheet Type:

1. Cut polyethylene sheet to a length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

D. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

E. Openings in Encasement: Create openings for branches, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with any resulting damaged areas being repaired as specified.

F. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.

3.3 REPAIRS

A. Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 11 52.00 Add – VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes:
   1. Valve boxes for water service
   2. Meter boxes for water service
   3. Meter vaults for water service

1.2  RELATED SECTIONS

Section 31 23 23.13 – Utility Backfill Materials
Section 31 23 35.00 – Excavation and Backfill for Utilities
Section 32 13 15.00 – Concrete for Utility Construction
Section 33 08 40.00 – Frames, Grates, Rings, and Covers
Section 33 11 15.00 – Polyvinyl Chloride Pipe
Section 33 50 10.00 - Ductile - Iron Pipe and Fittings

1.3  REFERENCES

1.4 MEASUREMENT AND PAYMENT

A. No separate payment will be made for Valve boxes under this Section. Include cost in unit price for Section 33 11 13.01 – Water Mains.

B. No separate payment will be made for Meter boxes under this Section. Include cost in unit price for Section 33 11 13.01 – Water Mains.

C. Meter vaults shall be paid for each size of vault installed. Payment will be made for each vault installed regardless of depth.

1.5 SUBMITTALS

A. Submit manufacturers’ product data for following items for approval:
   1. Each type of valve box and lid.
   2. Each type of meter box and cover.
   3. Each type of meter vault frame and cover.

B. Submit design calculations and shop drawing for precast vault elements, sealed by an Engineer registered in State of Texas.

C. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

PART 2 PRODUCTS

2.1 VALVE BOXES

A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.

B. Cast letter “W” in lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.

C. Unless otherwise specified, uncoated cast iron.

D. Riser Pipe.
   1. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Section 33 11 15.00 – Polyvinyl Chloride Pipe or
   2. 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Section 33 50 10.00 – Ductile Iron Pipe and Fittings.
   3. Provide single section of pipe.

E. Concrete for valve box placement:
   1. For locations in new concrete pavement, provide strength and mix design of new pavement.
2. For other locations, provide concrete conforming to requirements of Section 32 13 15.00 – Concrete for Utility Construction.

2.2 METER BOXES

A. General

1. Provide meters of type and size as indicated on Drawings, unless otherwise indicated.

2. Provide bolted split casings. Main casings of meters and external fasteners: Copper alloy with minimum 75 percent copper for 5/8 inch to 2 inches, bronze or cast iron, hot-dipped galvanized or epoxy coating for 3 inches and larger.

3. Straightening Vanes: Non-corrosive material compatible with case material.

4. Intermediate gear train shall not come into contact with water and shall operate in suitable lubricant.

5. Registers: Standard; permanently sealed; straight-reading; center-sweep test hand; magnetic driven; U.S. gallons; adaptable to remote read. Digits: 6, black in color with lowest registering three digits (below 1,000-gallon registration) having contrasting digit and background color. Register capacity of meters: 9.99 million gallons for 5/8 inch to 2 inches and 999,999 million gallons for 3 inches and larger.

6. Connections: 5/8 inch to 1 inch: threads at each end; 1-1/2 to 2 inches: two-bolt oval flanges each end; 3 inches and larger: flange at each end.

7. Register Boxes: Glass: high-impact strength tempered, encased in high content copper or stainless steel housing; rings and covers; copper alloy with minimum 57 percent copper.

8. Stamp manufacturer's meter serial number on outer case and on outside of register lid. Manufacturer's serial numbers shall be individual and not duplicated.

9. Meters: Shall be adaptable to direct-reading, remote registers or electronic meter reading technology. Compound Meter manufactured by: Hersey Products, Neptune, Sensus or approved substitution. Fire service Meters shall be manufactured by Hersey Products, Neptune, Sensus or approved substitution. Displacement meters shall be Badger, Neptune, Hershey, Kent, Sensus, or approved substitution.

10. Manufacturing Quality Control shall permit successful interchangeability from one meter to another of same size including registers, measuring chambers and units, discs or pistons as units, change gears, bolts, nuts, and washers without affecting accuracy of new meter.

B. Meter Applications

1. Sizes 3" and above Meters:

   a. Compounds:
1) Multi-family dwellings
2) Motels and hotels
3) Hospitals
4) Schools
5) Restaurants
6) Office buildings
7) Dormitories, nursing homes, department stores, shopping malls, and other commercial establishments

Note: Provide fire service type for sizes larger than 6 inches.

b. Fire Service Type: Designated fire protection lines.

C. Materials

1. Potable Water – Fire Water Compound Meter:
   a. Compound Type: The 10" size unit meter shall combine a mainline meter for measuring large flows (fire water) and a bypass compound (potable water) for recording flows at lower rates. The unit shall automatically control flows between the mainline and bypass section. The combined readings of the mainline meter and the bypass meter shall indicate the total consumption throughout the system. The meter shall comply with the latest standards of AWWA-C703.

2. Direct-Reading, Remote-Registration Systems: AWWA C 706; for use with cold water meters listed above by replacing only register; Two-wire, electrical signal transmission assembly compatible with meter used.

D. Strainers

1. Displacement Potable Water Meters 5/8 inch through 2 inches: Self-straining by means of annular space between measuring chamber and external case or with strainer screens installed in meter. Provide rigid screens which fit snugly, are easy to remove, with an effective straining area at least double that of main case inlet.

2. Potable Water Meters 2-inch diameter and larger: Equip with separate external strainer with bronze body for diameters less than 8 inches. Eight-inch diameter and larger may be cast iron, hot-dipped galvanized or epoxy coating. Strainers: Bolted to inlet side of meter, detachable from meter, easily removable lid. Strainer screen: Made of rounded cast bronze, stainless steel wire, having a nominal screen size of 3-1/2 mesh-per-inch (U.S. Series) not less than 45 percent clear area.

3. Provide separate external strainers approved for use in fire service metered connections by Underwriters Laboratories. Bodies: Cast iron or copper alloy. Ends: Flanged in accordance with ANSI B 16.1, Class 125. Provide stainless
steel basket. Strainers shall be detachable from meter. Manufacturers shall be by Badger, Hersey, Neptune, Sensus, or approved substitution.

E. Connections And Fittings

1. Provide pipe for connections in accordance with Section 33 50 10.00 - Ductile - Iron Pipe and Fittings.

2. Fittings shall be restrained ductile iron push-on bell joints or mechanical joint fittings for use outside of meter vaults. Use sealed Class 125 cement mortar lined flanged joints inside meter vaults.

F. Laying Lengths

1. Minimum laying lengths for meter and standard strainer shall be as shown on Drawings.

2.3 METEER VAULTS

A. Meter vaults may be constructed of precast concrete, cast-in-place concrete, or common brick masonry unless a specific type of construction is required by Drawings.

B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Section 32 13 15.00 – Concrete for Utility Construction with minimum compressive strength of 4000 psi at 28 days.

C. Reinforcing steel for meter vaults: Conform to requirements of Section 32 13 15.00 – Concrete for Utility Construction.

D. Grates and Covers: Conform to requirements of Section 33 08 40.00 – Frames, Grates, Rings, and Covers.

PART 3 EXECUTION

3.1 EXAMINATION

A. Obtain approval from Project Manager for location of meter vault.

B. Verify lines and grade are correct.

C. Verify compacted subgrade will support loads imposed by vaults.

3.2 VALVE BOXES

A. Install riser pope with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.

1. Install with bell on top of valve

2. Place riser pipe in plumb, vertical position

B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched
out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.

C. Set, align, and adjust valve box so that lid is level with final grade.

D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by City, repaint covers black.

3.3 METER BOXES

A. Tapping And Service Line Installation

1. Service Line:
   a. Use pipe and fittings conforming to requirements of Section 33 50 10.00 - Ductile-Iron Pipe and Fittings.
   b. Limit pulling and deflecting of joints to limits recommended by manufacturer.
   c. Make vertical adjustments with offset bends where room will permit. Minimize number of bends.
   d. Provide a minimum of ten pipe diameters of straight pipe length upstream and downstream of meter vault.

B. Meter Fitting Hookup

1. Support meter piping and meter, level and plumb, during installation. Support meters 3 inches and larger with concrete at a minimum of two locations.

2. Use round flanged fittings inside meter box or vault except for mechanical joint to flange adapter. Provide full-face 1/8-inch black neoprene or red rubber gasket material on flanged joints. Provide bolts and nuts made from approved corrosion-resistant material.

3. Tighten bolts in proper sequence and to correct torque.

4. Visually check for leaks under normal operating pressure following installation. Repair or replace any leaking components.

C. Testing

1. Accuracy registration tests will be conducted in accordance with the latest revision of AWWA standard for type and size of meter. Tests will be run on meters prior to installation by Port of Houston Authority designee. All meters 3 inches and larger shall be tested.

3.4 METER VAULTS

A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.
B. Precast Meter Vaults:
   1. Install precast vaults in accordance with manufacturer’s recommendations. Set
      level on a minimum 3-inch-thick bed of sand conforming to requirements of
   2. Seal lifting holes with cement-saint mortar or non-shrink grout.

C. Meter Vault Floor Slab:
   1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per
      foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4
      inches deep, unless other dimensions are required by Drawings. Install dowels
      at maximum of 18 inches, center-to-center for keying walls to floor slab.
   2. Precast floor slab elements may be used for precast vault construction.

D. Cast-in-Place Meter Vault Walls:
   1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum
      wall thickness shall be 4 inches.
   2. Cast walls monolithically. One cold joint will be allowed when vault depth
      exceeds 12 feet.
   3. Set frame for cover in concrete.

3.5 FRAME AND COVER FOR METER VAULTS

A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:
   1. In unpaved areas, set top of meter box or meter vault cover 2 to 3 inches above
      natural grade.
   2. In paved areas, set top of meter box or meter vault cover flush with adjacent
      concrete but no higher than 1/2-inch.

3.6 BACKFILL

A. Provide bank run sand in accordance with Section 31 23 23.13 – Utility Backfill Materials
   and back and compact in accordance with Section 31 23 35.00 – Excavation and Backfill
   for Utilities.

B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform
   slope 1-to-5 slope from top to natural grade.

C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved
   area.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 11 53.00 Add – GATE VALVES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes gate valves.

1.2 RELATED SECTIONS

Section 31 23 35.00 - Excavation and Backfilling for Utilities

Section 33 14 00.00 - Hydrostatic Testing of Pipelines

Section 33 51 40.00 - Disinfection of Waterlines

1.3 REFERENCES

A. American Society for Testing Materials (ASTM).
   3. ASTM B 62 – Composition Bronze or Ounce Metal Casting.

B. American Water Works Association (AWWA).
   1. AWWA C 500 - Gate Valves, 3 through 48 in. NPS, for Water and Sewage Systems.
   2. AWWA C 509 – Resilient-seated Gate Valves, 3 through 12 NPS, for Water and Sewage Systems.

1.4 MEASUREMENT AND PAYMENT

A. No separate payment will be made for gate valves that are 20 inches in diameter and smaller under this Section. Include cost in unit price for water lines.
B. No separate payment will be made for blow-off valve, box or associated concrete pad or other appurtenances under this Section. Include cost in unit price for water lines.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit manufacturer's product data for gate valves for approval.

1.6 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500 and AWWA C 509.

PART 2 PRODUCTS

2.1 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes less than 16-inches. If type of valve is indicated, no substitute is allowed.

C. Gate Valves 1-1/2 inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends; such as Crane No. 428, or approved substitution.

D. Coatings for Gate Valves 2 Inches and Larger: AWWA C 550; Indurall 3300 or approved substitution, non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.

E. Gate Valves 2 Inches in Diameter: Iron body, double gate, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.

F. Gate Valves 4 Inches to 12 Inches in Diameter: Non-directional, resilient seated (AWWA C 509) or parallel seat double disc (AWWA C 500), 200 psig, bronze mounting, flanged ends with flanged gaskets, and nut-operated unless otherwise specified. Provide resilient seated valves manufactured by American Darling AFC-500, US Pipe Metroseal 250, or approved substitution. Provide double disc valves manufactured by American Darling 52, Clow F-6102, or approved substitution. Comply with following requirements:

1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.

2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.

4. Stems: ASTM B 763 bronze, alloy number 995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.

5. Gasket: US Pipe Flange-Tyte or approved substitute.

6. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar.


8. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

9. Bolts: AWWA C 509 Section 4.4; stainless steel; cadmium plated, or zinc coated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Earthwork. Conform to applicable provisions of Section 31 23 35.00 - Excavation and Backfilling for Utilities.

B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.2 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face if less than 4 feet. Install valves completely closed when placed in water line.

C. For pipe section of each valve box, use only ductile iron, or DR18 PVC pipe cut to proper length. Size to allow future operation of valve. Assemble and brace box in vertical position as indicated on Drawings.

3.3 DISINFECTION AND TESTING

A. Assist Port Construction Representative with disinfection of valves and appurtenances as required by Section 33 51 40.00 - Disinfection of Waterlines and test as required by Section 33 14 00.00 - Hydrostatic Testing of Pipelines.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice the rated working pressure of valve between discs. The valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. The valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed a leakage rate of 1 oz/hr/inch of nominal valve size.
C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. The valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. The valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed a leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed the leakage rate.

3.4 PAINTING OF VALVES

A. Paint valves in vaults, stations, and above ground using ACRO Paint No. 2215, or approved substitute.
PART 1  GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes field hydrostatic testing of newly installed water pipelines.

B. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) water mains and large-diameter (greater than 20 inches) water mains. When specifications for large-diameter water mains differ from those for small-diameter water mains, paragraphs for large-diameter mains will govern for large-diameter pipe.

1.2 RELATED SECTIONS

Section 01 50 00.00, Temporary Facilities and Controls
Section 33 11 13.01 Water Mains
Section 33 30 00.00 General Sanitary Sewers
Section 33 34 00.00 Sanitary Utility Sewerage Force Mains
Section 33 51 40.00 - Disinfection of Water Lines

1.3 MEASUREMENT AND PAYMENT

A. No separate payment will be made for Hydrostatic Testing of Pipelines under this Section. Include cost in unit price of pipelines being tested.

PART 2  PRODUCTS (NOT USED)

PART 3  EXECUTION

3.1 PREPARATION

A. Disinfect water system pipelines prior to hydrostatic testing.

B. Hydrostatically test newly installed water pipelines after disinfection, if required, and before connecting to the City of Pasadena water distribution system.

C. Water for testing will be charged to Contractor in accordance with Section 01 50 00.00, Temporary Facilities and Controls. Prior to hydrostatic testing, Contractor's meter shall be tested, approved, and sealed by the Port Construction Representative.
D. For large-diameter water mains, test pipelines in lengths between valves, or plugs, of not more than 4400 feet.

E. Small-diameter pipelines shall be tested in lengths between valves, or plugs, of not more than 1500 feet.

F. Conduct hydrostatic tests in presence of Port Construction Representative.

3.2 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

B. Allow pipeline to sit a minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.

C. For small-diameter pipelines, expel air and apply a minimum test pressure of 125 psi. For large-diameter water mains, expel air and apply a minimum test pressure of 150 psi.

D. Begin test by 9:00 a.m. unless otherwise approved by the Port Construction Representative. Maintain test pressure for 8 hours. If a large quantity of water is required to maintain pressure during test, testing shall be discontinued until cause of water loss is identified and corrected.

E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.3 ALLOWABLE LEAKAGE FOR WATER MAINS

A. During hydrostatic tests, no leakage will be allowed for sections of water mains consisting of welded joints.

B. Maximum allowable leakage for water mains with rubber gasketed joints: 10.63 gallons per inch nominal diameter per mile of pipe per 24 hours while testing at 125 psi or 11.65 gallons per inch nominal diameter per mile of pipe per 24 hours while testing at 150 psi.

3.4 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove any cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. The Port Construction Representative may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Section 33 51 40.00 - Disinfection of Water Lines. Contractor shall pay for water required for additional disinfection and retesting.

C. Repeat test until satisfactory results are obtained.
3.5 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL
SECTION 33 30 00.00 Add – GENERAL SANITARY SEWERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes the furnishing, placing and construction of sanitary sewers, manholes, inlets, miscellaneous structures, and appurtenances for the construction of new sanitary sewer systems as described and specified herein and elsewhere in other sections of the contract specifications and as shown on the Drawings. The work under this Item includes the furnishing of all materials, equipment, supplies and tools, the performance of all labor and services, and all incidentals necessary to complete the new installation in a neat and workmanlike manner.

B. Sanitary sewers shall be PVC pipe, as indicated and detailed on the Drawings and in accordance with the specifications.

C. Connections to existing sanitary sewers shall be made as shown by the Drawings and as specified.

1.2 RELATED SECTIONS

Section 01 57 25.00 - Ground Water and Surface Water Control.
Section 03 10 00.00, Concrete Formwork
Section 03 21 00.00, Reinforcing Steel
Section 31 23 35.00 - Excavation and Backfill for Utilities.
Section 32 12 16.00, Asphaltic Pavement
Section 32 13 13.00, Concrete Pavement
Section 33 08 40.00, Frames, Grates, Rings and Covers
Section 33 11 15.00, Polyvinyl Chloride Pipe and Fittings
Section 33 11 16.00 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe
Section 33 11 51.00 - Polyethylene Wrap
Section 33 30 00.00 - Acceptance Testing for Sanitary Sewers
Section 33 32 13.13 - Packaged Utility Lift Station
Section 33 34 00.00 - Sanitary Utility Sewerage Force Mains
Section 33 42 70.00, Plastic Liner for Large Diameter Concrete Sewers and Structures

1.3 MEASUREMENT AND PAYMENT

A. Sewer pipe, laterals, stubs and inlet leads shall be paid for on a Linear Foot basis for each size of pipe installed, including furnishing all labor, furnishing and installing all pipe, furnishing all material and equipment, for all hauling, excavation, shaping of trench bottom, all bracing, sheeting and lumber in the trench, for all backfilling and backfill material, tamping backfill, removal of surplus excavated material, and for all clean up and incidentals necessary to furnish sewer pipe and inlet leads complete in place.
Measurement will be taken along centerline of pipe from centerline to centerline of manholes.

B. Payment shall be made for Each manhole, including furnishing all labor; all materials, including concrete, mortar and brickwork; pumping, excavation, hauling, and disposal of surplus earth; backfilling and tamping; connection of leads, stubs and sewer lines to the manhole; manhole PVC lining and all other incidentals necessary to complete the manhole. No separate payment shall be made for manhole frames and covers, which items shall be considered incidental to the manhole.

C. Cleanouts shall be paid for on a unit price basis for Each cleanout constructed, regardless of the type of cleanout (double or single), including furnishing all labor, tools and equipment; all materials, including pumping, excavation, hauling, and disposal of surplus excavated material; backfilling and compacting; and all other incidentals necessary to complete the cleanout.

D. No separate payment will be made for Concrete base pavement with asphalt surface, concrete pavement, sidewalks and driveways removed under this Section. Include in cost for work as specified in Section 02 41 13.13 – Removal of Existing Pavement and Structures.

E. No separate payment will be made for Concrete curbs and gutters or any concrete or masonry structure. Include in cost for work as specified in Section 02 41 13.13 – Removal of Existing Pavement and Structures.

F. No separate payment will be made for removal and disposal of flexible base under this Section. Include cost in unit price for work as specified in Section 02 41 13.13 – Removal of Existing Pavement and Structures.

G. No separate payment will be made for Flexible base material and surfacing, if any, which has been salvaged from roads on orders of the Port Construction Representative under this Section. Include cost in unit price for work as specified in Section 32 11 33.00 – Cement Treated Base Course.

H. No separate payment will be made for Concrete base of concrete pavement replaced under this Section. Include cost in unit price for work as specified in Section 32 13 13.00 – Concrete Pavement.

I. No separate payment will be made for Hot Mix Asphalt Concrete Surfacing under this Section. Include cost in unit price for work as specified in Section 32 12 16.00 – Asphaltic Pavement.

1.4 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit, to the Port Construction Representative for approval, a complete list, including catalog data and descriptive matter, of all equipment he proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Construction Representative.

1.5 PROTECTION

A. All work, equipment and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workmen. Work shall be properly protected to prevent obstruction or damage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be tightly covered and protected against dirt, water, and chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.
PART 2 PRODUCTS

2.1 MATERIALS FOR SANITARY SEWER SYSTEM

A. Unless otherwise shown on the Drawings, use pipe materials that conform to requirements specified in one or more of the following Sections:

1. PVC Pipe for gravity and pressure sewer piping as indicated on the drawings: Refer to Section 33 11 15.00, Polyvinyl Chloride Pipe and Fittings.

2. Concrete: Concrete for manholes, liftstations, and other structures shall be Class A concrete as provided for in Section 03 10 00.00, Concrete Formwork.

3. Reinforcing Steel: Reinforcing steel bars where indicated on the Drawings for sewer structures, and special sewer structures shall be new billet steel reinforcing bars, conforming to the requirements of Section 03 20 00.00, Reinforcing Steel.

4. Cast Iron Frames, Covers: Refer to Section 33 08 40.00, Frames, Grates, Rings and Covers.

5. Plastic liner for manholes: refer to Section 33 42 70.00, Plastic Liner for Large Diameter Concrete Sewers and Structures.

6. Fiberglass Manhole Steps: Steps in inlets, manholes and junction boxes, to be installed in accordance with details shown on the Drawings, shall be yellow fiberglass “Perma Step” ten inches (10”) wide as manufactured by Utility Products, Inc., or approved substitute.

PART 3 EXECUTION

3.1 SANITARY SEWER SYSTEM INSTALLATION

A. Excavation, Trenching, and Backfilling for PVC Sanitary Sewer, Manholes, and Appurtenances:

1. Excavation-General:
   a. Whatever substances are encountered shall be excavated to the depth of sewers, manholes, and other sanitary sewer structures shown on the Drawings. Excavated material shall be used for fill or backfill, as directed by the Port Construction Representative, unless otherwise specified.
   b. The Contractor shall furnish and place, in positions as directed by the Port Construction Representative, all the necessary batter boards for locating the work. The grade boards shall be of such size timber as the Port Construction Representative directs and be substantially supported. The batter boards shall be one-inch by three inches, planed on all four sides to truly parallel faces. The Boards and all location stakes must be protected from injury or change. Twilled lines for use in giving lines and grades and the necessary plummets and graduated poles shall be of a form approved by the Port Construction Representative.
   c. Excavations for manholes and other accessories shall have 12" minimum and 24" maximum clearance on all sides.
   d. Excess excavations below required level, except as otherwise specified, shall be backfilled with earth, sand, gravel, or concrete as directed by the Port Construction Representative, and thoroughly tamped.
   e. Unstable soil shall be removed and replaced with select material approved by the Port Construction Representative and thoroughly tamped into place. The Port Construction Representative shall determine the depth of removal of unstable soil.
f. Ground adjacent to all excavations shall be graded to prevent water running in and any water accumulated in the excavations will be removed by pumping or other means approved by the Port Construction Representative, in accordance with Section 01 57 25.00 – Ground water and Surface Water Control

2. Trench Excavation:
   a. Unless otherwise specified, all sewers shall be constructed in open cut trenches with vertical sides. Trenches for pipe sewers shall have a width below the top of the bell of said pipe or other joining arrangement not to exceed the width of the pipe plus 16 inches, and not less than the width of the pipe plus 12 inches. Above the tops of pipe bells, the width of the trenches may be greater than the limits specified above by an amount sufficient only to permit placing sheathing and bracing timbers and to permit installation of well point headers or manifold and pumps in the trench where the depth of trench is such as to make it uneconomical to pump from surface installation. Sufficient space must be provided between cross braces to permit handling of forms, pipe and other materials.
   b. Conform to requirements of Section 31 23 35.00 – Excavation and Backfill for Utilities.

3. Dewatering Trench:
   a. No PVC pipe sewer shall be laid in a trench in the presence of water. All water shall be removed from trench sufficiently ahead of sewer placing operation to ensure a dry, firm bed on which to place the sewer, and trench will continue to be dewatered until after all concrete, mortar, and joint material is set. Removal of water may be accomplished by bailing, pumping, or pumping in connection with well-point installation as the particular situation may warrant.
   b. If the presence of excessive amounts of water in the ground at bottom of trench makes it impossible or impracticable, in the opinion of the Port Construction Representative, to adequately support the reinforcing steel above the ground to provide the required cover of sewer concrete or to pour the sewer concrete in a dry trench, the Contractor will be required to excavate additional depth and pour a concrete seal slab of approximately 3-inches thickness in the affected area.
   c. Contractor shall not place reinforcing steel and forms upon any seal slab until 48 hours after the pouring thereof, unless otherwise permitted by the Port Construction Representative.
   d. Concrete for seal slab, if required, shall be Class H Concrete as provided for in Section 03 10 00.00, Concrete Formwork.

4. Bracing and Shoring: When necessary, in the Port Construction Representative’s opinion, the sides of the trench shall be braced and rendered secure to the satisfaction of the Port Construction Representative, until the sewer has been laid and the trenches backfilled, as hereinafter specified to a depth of at least twelve inches above the top of the sewer. All bracing or sheet piling or sheeting shall be provided at the contractor’s expense, and no extra compensation will be allowed therefore except such timber that is ordered left in the trench by the Port Construction Representative.

5. Backfilling:
a. The following method of backfilling shall be used over and around PVC pipe, manholes, and other sewer appurtenances.

b. The foundation soil shall be of uniform density, either undisturbed in the bottom of the trench or compacted to a dry density equal to that of adjoining natural ground if undercut and backfilled. The foundation soil shall be carefully shaped to fit the lower one-third of the outside circumference of the pipe and to allow tamping backfill under the pipe at each side of this bedding. The foundation shall conform to the flow line and gradient shown on the Drawings.

c. After the bedding and setting of the culvert has been approved by the Port Construction Representative, selected backfill material, free from clods or rocks, shall be deposited in layers not exceeding six (6) inches in depth (loose measure) and thoroughly compacted with pneumatic tampers. Each layer of soil shall be moistened or dried or near optimum moisture content and compacted to a dry density of not less than ninety-five percent (95%) of the maximum laboratory dry density as determined by Method A of the AASHTO Standard Method of Test for the Moisture Density Relations of Soils Using a 5.5 Pound Rammer and a 12-Inch Drop (AASHTO Designation T99, latest revision). This method of placement shall be continued until the top of the pipe is covered with at least twelve (12) inches of soil or the trench has been backfilled to the top of adjoining grade.

d. The backfill around manholes and other structures under pavements and railroads shall not be placed until the day after the structure is built and shall be power tamped from the bottom of the excavation to the subgrade, compacted the same as specified above the connecting sewers and leads in these areas.

B. Pipe Installation by open-cut:

1. Perform excavation, bedding, and backfill in accordance with Section 31 23 35.00 - Excavation and Backfill for Utilities.

2. Wrap ductile-iron pipe and fittings with polyethylene wrap in accordance with requirements of Section 33 11 51.00 - Polyethylene Wrap. Polyethylene wrap shall not be installed on ductile iron pipe protected by a cathodic protection system.

3. Install pipe in accordance with the pipe manufacturer's recommendations and as specified in the following paragraphs.

4. Install pipe only after excavation is completed, the bottom of the trench is fine graded, bedding material is installed, and the trench has been approved by the Port Construction Representative.

5. Install pipe to the line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in the trench so the interior surfaces of the pipe follow the grades and alignment indicated. Provide bell holes where necessary.

6. Install pipe with the spigot ends toward the direction of flow. Form a concentric joint with each section of adjoining pipe so as to prevent offsets.

7. Keep the interior of pipe clean as the installation progresses. Where cleaning after laying the pipe is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull it forward past each joint immediately after the joint has been completed. Remove foreign material and debris from the pipe.
8. Provide lubricant, place and drive home newly-laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to “home” mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by the Port Construction Representative.

9. Keep excavations free of water during construction and until final inspection.

10. When work is not in progress, cover the exposed ends of pipes with an approved plug to prevent foreign material from entering the pipe.

11. Where sanitary sewer force main is to be installed under an existing water line with a separation distance of less than 2 feet, install one full joint length of pipe centered on the water line and maintain a minimum 6-inch separation distance.

C. Pipe installation other than open-cut:

1. For installation of pipe by augering, jacking or tunneling, conform to requirements of specification section of augering or tunneling work.

D. Pipe Bedding:

1. The pipe shall be bedded in the trench as described herein and as shown on the Drawings. In every case where trenches have been excavated below the specified depth for bedding, the depth of bedding below pipe shall be increased to fill the overdepth space.

2. Except under railroad tracks, bedding shall be done in the following manner and as shown by Bedding Detail for Pipe Sewers on the Drawings:
   
   a. The bottom of the trench for the pipe barrel shall be excavated to a line parallel to the flow line of the pipe and to a depth of not less than three inches (3”) below the bell when bell and spigot is used, and not less than five inches (5”) below the outside surface of the pipe barrel when tongue and groove pipe is used. Then cement stabilized sand shall be spread over the entire bottom of the sewer trench to the flow line grade of the sewer after which the subgrade conforming to the outside shape of the pipe shall be prepared. Cement stabilized sand shall be used to backfill the sewer trench up to the horizontal diameter of the pipe after the pipe has been installed. The cement stabilized sand for pipe bedding and pipe trench backfill shall be composed of San Jacinto (concrete aggregate) sand and not less than one and one-half (1-1/2) sacks of Portland cement per cubic yard of mixture, mixed in a concrete type mixer. This material cannot be used after it loses its moisture content or dries out. It shall be rodded in the trench and the area between the horizontal diameter of the pipe and bottom of the trench shall be free of cavities.

   b. Loose earth backfill material shall be placed to a depth of 6” above the pipe before ceasing operations for the day. No backfill in excess of 6” above the top of the pipe shall be placed on the same day the pipe is laid and bedded. Backfill above the pipe shall be done as prescribed for backfilling sewers elsewhere in this Technical Specification. Where the trench bottom seeps water to the extent soft unstable conditions are produced, washed shell must be substituted for cement stabilized sand under the pipe.

   c. Alignment of pipe will be checked and any misalignment shall be corrected as set out for sewer pipe, regardless of type of bedding.
E. Pipe Jointing:
1. Install pipe in accordance with the pipe manufacturer’s recommendations and as specified in the following paragraphs.

2. Install pipe only after excavation is completed, the bottom of the trench fine graded, bedding material is installed, and the trench has been approved by the Port Construction Representative.

3. Install pipe to the line and grade indicated.  Place pipe so that it has continuous bearing of barrel on bedding material and is laid in the trench so the interior surfaces of the pipe follow the grades and alignment indicated.  Provide bell holes where necessary.

4. Install pipe with the spigot ends toward the direction of flow.

5. Form a concentric joint with each section of adjoining pipe so as to prevent offsets.

6. Keep the interior of pipe clean as the installation progresses.  Where cleaning after laying the pipe is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull it forward past each joint immediately after the joint has been completed.  Remove foreign material and debris from the pipe.

7. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections.  Install pipe to “home” mark where provided.  Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by the Port Construction Representative.

8. Keep excavations free of water during construction and until final inspection.

9. When work is not in progress, cover the exposed ends of pipes with an approved plug to prevent foreign material from entering the pipe.

10. Where gravity sanitary sewer is to be installed under an existing water line with a separation distance of at least 2 feet and less than 9 feet, install the new sewer pipe so that one full joint length of pipe is centered on the water line crossing.  Embed the sewer pipe in cement stabilized sand for a minimum distance of 9 feet on each side of the crossing.

11. Where gravity sanitary sewer is to be installed under an existing water line with a separation distance of less than 2 feet, install the new sewer using pressure-rated pipe as shown on the Drawings.  Maintain a minimum 6-inch separation distance.

12. Where the length of stubs is not indicated, install a 4-foot length an seal the free end with an approved plug.

F. Manholes:
1. Manholes shall be constructed at locations shown on the Drawings, of the type and depth indicated, in accordance with details shown in the Drawings and these specifications.  Design loading criteria shall match the minimum requirements described in Section 33 05 15.

2. Walls may be constructed of concrete Class “A” or of brick. Where brick is used in the construction of manholes every fifth course of brick shall be laid in such a manner as to effect tie between such course and the courses immediately thereunder. In general, the long axis of the tie course will be perpendicular to the long axis of the preceding four courses. Thoroughly wet brick before laying.

3. On pipe sewers, the concrete foundation for manholes shall be placed as soon as practicable after the sewer is complete through the manhole location.  Cast
iron steps shall be placed in walls as shown on the Drawings. One-half inch mortar joints shall be used in brick work, struck flush on inside of manhole. The outside of brick manholes shall be plastered with one-half inch mortar cover, carried up with the brick work.

4. All mortar shall consist of one part Portland cement and three parts clean, durable, sharp sand meeting the specifications for concrete materials.

5. Where inlet leads, main or lateral pipe sewers enter manholes, pipes shall be cut off flush with inside of manhole and any irregularities shall be pointed up with mortar.

6. Set the cast iron manhole cover frame in a full mortar bed and adjust to the elevations on the Drawings. The inverts of the sewer lines entering the manhole at or near the flow line elevation of the manhole shall be shaped and grouted across the floor of the manhole using mortar to obtain the proper contour.

G. Miscellaneous and Special Concrete Sewer Structure: All miscellaneous and special reinforced concrete drainage structures shall be constructed of materials indicated on the Drawings and specified hereinbefore for sewers, manholes, and inlets, to location, line and grades and in accordance with details shown on the Drawings. Excavation and backfill methods shall be in accordance with applicable specifications provided hereinbefore for concrete sewers, inlets and manholes.

H. Removal and Replacement of Street Base and Surface:

1. Description: The work to be performed under this Item of the Technical Specifications shall consist of the removal, salvaging, and/or disposal of excess material and the replacing of base and surface removed in connection with the construction of sewers and appurtenances.

2. Construction Method:
   a. Where sewer construction involves the cutting of a concrete, or concrete base street, the pavement shall be cut two feet wider than the width of trench necessary to install the sewer in a manner that will provide a minimum of one foot of undisturbed subgrade on each side of the trench to provide additional support for the slab when replaced. After the trench has been backfilled and compacted to the satisfaction of the Port Construction Representative, the area on which the concrete slab is to be replaced shall be fine graded to provide the minimum thickness of slab as set out on Drawings. Reinforcing steel of the size, length and at the spacing shown shall be furnished and installed in accordance with Drawing.

   b. Use of drop hammer for breaking concrete pavement or base for removal will not be permitted. Concrete pavement shall be furnished and placed in accordance with the Section 32 13 13.00, Concrete Pavement.

   c. Where the pavement consists of a concrete base with asphalt surfacing, the new concrete base shall be surfaced with not less than 1-1/2” of hot mix asphalt concrete surfacing mixed and placed in accordance with the Section 32 12 16.00, Asphaltic Pavement and special provisions thereto, if any.

   d. Where the installation of the sewer involves cutting an existing flexible base, the Contractor shall, when ordered by the Port Construction Representative, remove and store excavated base and bituminous surface material within the limits designated by the Port Construction Representative. The Contractor shall take all necessary precautions to prevent mixing foreign materials with the base material during the entire
salvaging operation. After the trench has been backfilled, the salvaged material shall be replaced in layers not to exceed six (6") inches in depth, loose measurement, and each layer compacted by wetting and rolling with pneumatic tires until no further settlement is noticeable.

e. Where additional or new base material is required, and its placing is authorized by the Port Construction Representative, it shall be furnished in accordance with the paving specifications covering the type material set out in the proposal for flexible base replacement.

f. Where the existing flexible base has been surfaced with a bituminous surfacing, the base replaced under this Item shall be surfaced in accordance with Section 32 12 16.00, Asphaltic Pavement.

3.2 TESTING SEWERS FOR LEAKAGE

A. General:

1. Sewers, when tested as herein provided, shall not show leakage of more than 200 gallons per 24 hours per inch of inside diameter per mile of sewer. A low-pressure air test shall be performed to demonstrate the structural integrity of all sewer lines constructed under this Contract.

2. Tests shall be performed by the Contractor in the presence of the Port Construction Representative after the sewer trenches have been completely backfilled but prior to placing any pavement surfaces over the sewers. Manholes shall be excluded from the tests; however, if excessive leakage into manholes is apparent, the Contractor shall be required to repair such leaks to the satisfaction of the Port Construction Representative. Tests shall be performed between the inlet side of downstream manholes and the outlet side of the next upstream manhole.

3. The Contractor shall supply all test plugs, materials, equipment, apparatus, labor, supervision and any other incidentals necessary to perform the tests in accordance with the procedures outlined in these Technical Specifications.

B. Air Testing of Sewers:

1. Safety Precautions:
   a. It is extremely important that the test plugs be installed so as to prevent the sudden expulsion of an improperly installed or partially inflated plug. All plugs shall be installed securely and braced against the walls of the manhole. The lines shall not be pressurized beyond the pressures required to conduct the tests.
   b. No workmen shall be allowed in the manholes during testing because of the hazards involved. Inflation of the plugs and pressurization of the lines shall be controlled from the surface.

2. Preparation of the Line: Each section of the line to be tested shall be thoroughly cleaned prior to performing the test. After the lines are cleaned and free of dirt and debris, the Contractor shall fill the lines with water and allow the water to stand in the lines for two hours. The Contractor shall then pump the water out of the sewer system and proceed to perform the test.

3. Test Procedure:
   a. In accordance with the safety precautions contained in Item Safety Precautions above, plug all openings in the section of sewer to be tested.
   b. After plugs are properly installed, add air to the line until the internal pressure of the line is raised to 4.0 psi. When this pressure is reached,
wait 4 minutes to allow the pressure to stabilize. When the pressure has stabilized and is at or above a starting test pressure of 3.5 psi, start the test.

c. If the pressure drops more than 1.0 psi during the test time, based on the table below, the line is considered to have failed the test. If a 1.0 psi pressure drop does not occur within the test time, the line has passed the test.

**TABLE 1 Minimum Test Time for Various Pipe Sizes**

<table>
<thead>
<tr>
<th>Nominal Pipe Size, In.</th>
<th>T(Time), Min/100 Ft.</th>
<th>Nominal Pipe Size, In.</th>
<th>T(Time), Min/100 Ft.</th>
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C. Repair of Defective Sewers: Sections of the sewer that show leakage in excess of that which is permitted by these specifications shall be taken up and relaid or otherwise made good by repairs of a permanent nature made with methods and materials approved by the Port Construction Representative as being of a permanent type. Any individual leaks that may appear shall be repaired whether or not the overall section meets the leakage requirements. For this purpose, any steady stream will be considered a leak while a drip will not. Individual leaks will ordinarily be revealed by looking through the sewer with a light while the ground water level is over the sewer.

D. Retests: Sewers which fail to meet the requirements of the leak test will, after repairs by the Contractor have been completed, be again tested for leakage.

### 3.3 POST INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of any sand, debris, and liquid wastes to legal disposal sites.

B. Select and use closed-circuit television equipment that will produce a color video tape. Produce a video tape using a pan-and-tilt, radial viewing, pipe inspection camera that pans and minus 275 degrees and rotates 360 degrees. Use a camera with an accurate footage counter which displays on the monitor the exact distance of the camera from the starting manhole. Use a camera with camera height adjustment so that the camera lens is always centered at one-half the inside diameter, or higher, in the pipe being televised.
Provide a lighting system that allows the features and condition of the pipe to be clearly seen. A reflector in front of the camera may be necessary to enhance lighting in dark of large diameter pipe.

C. Perform television inspection of gravity sanitary sewers as follows:

1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.

2. Video tapes shall be continuous for pipe segments between manholes. Do not leave gaps in the video taping of a segment between manholes and do not show a single segment on more than one video tape.

3. No flow is allowed in the gravity sanitary sewer while performing post-installation television inspection.

D. Provide video tapes in the VHS format, recorded at Standard Play (SP). Two labels are required. One label shall be placed on the spine and the other on the face of each video tape. Permanently label each video tape with the following information

### Spine of Tape

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<th>Contractor’s Name:</th>
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<th>[ ] Post-Installation</th>
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<td>Date Submitted:</td>
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### Face of Tape

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END OF SECTION
PART 1  GENERAL

1.1  SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes acceptance testing of sanitary sewers including:

1. Visual inspection of sewer pipes
2. Mandrel testing for flexible sewer pipes.
3. Leakage testing of sewer pipes.
4. Leakage testing of manholes.
5. Smoke testing of point repairs.

B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections, which refer to this Section for testing criteria and procedures.

1.2  RELATED SECTIONS

Section 01 57 25.00 - Ground Water and Surface Water Control
Section 33 30 00.00 – General Sanitary Sewers
Section 33 32 13.13 – Packaged Utility Lift Station
Section 33 34 00.00 – Sanitary Utility Sewerage Force Mains

1.3  REFERENCES


C. 30 TAC 317.2 - Design Criteria for Sewage Systems.

D. Uni-Bell UNI-B-3 Polyvinyl Chloride (PVC) Pressure Pipe (Complying with AWWA C 900).
1.4 MEASUREMENT AND PAYMENT

A. No separate payment will be made for Acceptance Testing for Sanitary Sewers under this Section. Include cost in unit price for work requiring acceptance testing.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Test Plan: Before testing begins, prepare and submit a test plan for approval by the Port Construction Representative. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from the Drawings and Specifications.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.6 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have a straight alignment and uniform grade between manholes.

B. Flexible pipe, including “semi-rigid” pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of a line segment but prior to final acceptance using a standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. Maximum allowable leakage for Infiltration or Exfiltration

1. The total exfiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of 2 feet above the crown of the pipe at the upstream manhole or 2 feet above the groundwater elevation, whichever is greater.

2. When pipes are installed more than 2 feet below the groundwater level, an infiltration test shall be used in lieu of the exfiltration test. The total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above the crown of the pipe at the upstream manhole.

3. Refer to Table 1, Water Test Allowable Leakage, at the end of the Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.

D. Perform air testing in accordance with requirements of this Section and the Texas Commission on Environmental Quality (TCEQ) requirements. Refer to:

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 3</td>
<td>Minimum Testing Times for Low Pressure Air Test, and</td>
</tr>
<tr>
<td>Table 4</td>
<td>Vacuum Test Time Table, at the end of this Section</td>
</tr>
</tbody>
</table>
1.7 GRAVITY SANITARY SEWER QUALITY ASSURANCE

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.

B. Provide testing reports and video tape of television inspection as directed by Port Construction Representative.

C. Upon completion of tape reviews by the Port Construction Representative, the Contractor will be notified regarding final acceptance of the sewer segment.

1.8 SEQUENCING AND SCHEDULING

A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at any one time.

B. Coordinate testing schedules with the Port Construction Representative. Perform testing under observation of the Port Construction Representative.

PART 2 PRODUCTS

2.1 DEFLECTION MANDREL

A. Mandrel Sizing. The rigid mandrel shall have an outside diameter (O.D.) equal to 95 percent of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other “tolerance packages” shall not be considered in mandrel sizing.

B. Mandrel Design. The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more “runners” or “legs” as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75 percent of the inside diameter of the pipe. The rigid mandrel shall not have adjustable or collapsible legs which would allow a reduction in mandrel diameter during testing. A proving ring shall be provided and used for modifying each size mandrel.

C. Proving Ring. Furnish a "proving ring" with each mandrel. Fabricate the ring of 1/2-inch-thick, 3-inch-wide bar steel to a diameter 0.02 inches larger than approved mandrel diameter.

D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 5, Pipe vs. Mandrel Diameter, at the end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in the table may be used when approved by the Port Construction Representative.

2.2 EXFILTRATION TEST

A. Contractor shall coordinate with the proper City of Pasadena officials when water for testing will be taken from the City of Pasadena’s system.
B. Test Equipment:
   1. Pipe plugs.
   2. Pipe risers where the manhole cone is less than 2 feet above highest point in pipe or service lead.

2.3 INFILTRATION TEST
A. Test Equipment:
   1. Calibrated 90 degree V-notch weir.
   2. Pipe plugs.

2.4 LOW PRESSURE AIR TEST
A. Minimum Requirement for Equipment:
   1. Control panel.
   2. Low-pressure air supply connected to control panel.
   3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
   4. Air hoses from control panel to:
      a. Air supply.
      b. Pneumatic plugs.
      c. Sealed line for pressuring.
      d. Sealed line for monitoring internal pressure.

B. Testing Pneumatic Plugs: Place a pneumatic plug in each end of a length of pipe on the ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable if they remain in place against the test pressure without external aids.

2.5 GROUND WATER DETERMINATION
A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

2.6 SMOKE TESTING
A. Equipment:
   1. Pneumatic plugs.
   2. Smoke generator as supplied by Superior Signal Company, or an approved substitution.
PART 3 EXECUTION


3.1 PREPARATION

A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.

B. The selection of test methods and pressures for gravity sanitary sewers shall be determined based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 01 57 25.00 - Ground Water and Surface Water Control.

3.2 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

A. Check pipe alignment visually by flashing a light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

3.3 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of the line segment.

B. Pull the approved mandrel by hand through sewer sections. Replace any section of sewer not passing the mandrel. Mandrel testing is not required for stubs.

C. Retest repaired or replaced sewer sections.

3.4 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

A. Test Options:

1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.

2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo a physical inspection prior to testing.

3. Leakage testing shall be performed after backfilling of a line segment, and prior to tie-in of service connections.

4. If no installed piezometer is within 500 feet of the sewer segment, Contractor shall provide a temporary piezometer for this purpose.

B. Compensating for Ground Water Pressure:

1. Where ground water exists, install a pipe nipple at the same time sewer line is placed. Use a 1/2-inch capped pipe nipple approximately 10 inches long. Make
the installation through manhole wall on top of the sewer line where line enters manhole.

2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect a clear plastic tube to nipple. Support tube vertically and allow water to rise in the tube. After water stops rising, measure height in feet of water over invert of the pipe. Divide this height by 2.3 feet/psi to determine the ground water pressure to be used in line testing.

C. Exfiltration Test:

1. Determine ground water elevation.

2. Plug sewer in downstream manhole.

3. Plug incoming pipes in upstream manhole.

4. Install riser pipe in outgoing pipe of upstream manhole if highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.

5. Fill sewer pipe and manhole or pipe riser, if used, with water to a point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.

6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over a one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure the quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 1 at the end of this Section.

D. Infiltration Test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).

1. Determine ground water elevation.

2. Plug incoming pipes in upstream manhole.

3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.

4. Allow water to rise and flow over weir until it stabilizes.

5. Take five readings of accumulated volume over a period of 2 hours and use average for infiltration. The average must not exceed that calculated for 2 hours from allowable leakage according to the Table 1 at the end of this Section.

E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 2.

1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.

2. Lines 36-inch average inside diameter and larger shall be tested at each joint. The minimum time allowable for the pressure to drop from 3.5 pounds per square
inch gauge to 2.5 pounds per square inch during a joint test shall be 10 seconds, regardless of pipe size.

3. For pipe sections less than 36-inch average inside diameter:

a. Determine ground water level.

b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.

c. After a manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.

d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 2 at the end of this Section.

e. To determine air loss, measure the time interval for pressure to drop to 2.5 psig. The time must exceed that listed in the Table 2 at the end of this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.

F. Retest: Any section of pipe which fails to meet requirements shall be repaired and retested.

3.5 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 1, Water Test Allowable Leakage, at the end of this Section.

B. Low Pressure Air Test:

1. Times in Table 2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, at the end of this Section, are based on the equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria 317.2(a)(4)(B).

\[ T = 0.0850(D)(K)/(Q) \]

where:

\( T \) = time for pressure to drop 1.0 pounds per square inch gauge in seconds

\( K \) = 0.000419 DL, but not less than 1.0

\( D \) = average inside diameter in inches

\( L \) = length of line of same pipe size in feet

\( Q \) = rate of loss, 0.0015 ft³/min./sq. ft. internal surface
2. Since a K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 3, Minimum Testing Times for Low Pressure Air Test.

Notes:

1. When two sizes of pipe are involved, the time shall be computed by the ratio of lengths involved.

2. Lines with a 27-inch average inside diameter and larger may be air tested at each joint.

3. Lines with an average inside diameter greater than 36 inches must be air tested for leakage at each joint.

4. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing.

5. For joint test, the pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum times allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

3.6 LEAKAGE TESTING FOR MANHOLES

A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.

B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs a minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged if lines entering manhole have not been backfilled.

C. Vacuum Testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to the recommended maximum inflation pressure; do not over-inflate.

2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for the time period specified in Table 4, Vacuum Test Time Table.

3. If the drop in vacuum exceeds 1 inch Hg over the specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Hydrostatic exfiltration testing shall be performed as follows:
1. Seal wastewater lines coming into the manhole with an internal pipe plug. Then fill the manhole with water and maintain it full for at least one hour.

2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.

3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.7 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.
2. Determine if point repairs are properly made.
3. Determine if service connections have been reconnected to the rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in a single manhole section at any one time. Keep the number of open excavations to a minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to City of Pasadena Police and Fire Departments 24 hours prior to actual smoke testing.

D. Isolate Section: Isolate the manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal the annular space at manhole for sliplined sections.

E. Smoke Introduction:

1. Operate equipment according to manufacturer’s recommendation and as approved by the Port Construction Representative.
2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for a minimum of 5 minutes.
3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor the tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace any taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at a time. If repair or replacement, testing or retesting, and backfilling of the excavation is not completed within one work day, properly barricade and cover each excavation as approved by the Port Construction Representative.
G. Service Connections: In locations where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to the newly installed liner pipe, perform a dye test to confirm reconnection. Introduce dye into the service line through a plumbing fixture inside the structure or a sewer cleanout immediately outside the structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms a reconnection.
<table>
<thead>
<tr>
<th>DIAMETER OF RISER OR STACK IN INCHES</th>
<th>VOLUME PER INCH OF DEPTH</th>
<th>ALLOWANCE LEAKAGE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCH</td>
<td>GALLONS</td>
<td>PIPE SIZE IN INCHES</td>
</tr>
<tr>
<td>1</td>
<td>0.7854</td>
<td>0.0034</td>
</tr>
<tr>
<td>2</td>
<td>3.1416</td>
<td>0.0136</td>
</tr>
<tr>
<td>2.5</td>
<td>4.9087</td>
<td>0.0212</td>
</tr>
<tr>
<td>3</td>
<td>7.0686</td>
<td>0.0306</td>
</tr>
<tr>
<td>4</td>
<td>12.5664</td>
<td>0.0306</td>
</tr>
<tr>
<td>5</td>
<td>19.6350</td>
<td>0.0544</td>
</tr>
<tr>
<td>6</td>
<td>28.2743</td>
<td>0.1224</td>
</tr>
<tr>
<td>8</td>
<td>50.2655</td>
<td>0.2176</td>
</tr>
</tbody>
</table>

For other diameters, multiply square of diameters by value for 1" diameter. Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.

* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within the 25-year flood plain.
### TABLE 2

**ACCEPTANCE TESTING FOR SANITARY SEWERS**

**TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG**

<table>
<thead>
<tr>
<th>Pipe Dia. (in)</th>
<th>Min. Time (min: sec)</th>
<th>Length for Min. Time (ft)</th>
<th>Time for Min. Time (sec)</th>
<th>Time for Longer Length (sec)</th>
<th>Specification Time for Length (L) Shown (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 ft</td>
<td>5:40</td>
<td>398</td>
<td>0.8548</td>
<td>5:40</td>
<td>5:40</td>
</tr>
<tr>
<td>150 ft</td>
<td>7:33</td>
<td>298</td>
<td>1.5196</td>
<td>7:33</td>
<td>7:33</td>
</tr>
<tr>
<td>200 ft</td>
<td>9:27</td>
<td>239</td>
<td>2.3743</td>
<td>9:27</td>
<td>9:27</td>
</tr>
<tr>
<td>250 ft</td>
<td>11:20</td>
<td>199</td>
<td>3.4190</td>
<td>11:20</td>
<td>11:20</td>
</tr>
<tr>
<td>300 ft</td>
<td>14:10</td>
<td>159</td>
<td>5.3423</td>
<td>14:10</td>
<td>14:10</td>
</tr>
<tr>
<td>350 ft</td>
<td>17:00</td>
<td>133</td>
<td>7.6928</td>
<td>17:00</td>
<td>17:00</td>
</tr>
<tr>
<td>400 ft</td>
<td>19:50</td>
<td>114</td>
<td>10.4708</td>
<td>19:50</td>
<td>19:50</td>
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<tr>
<td>500 ft</td>
<td>25:30</td>
<td>88</td>
<td>17.3089</td>
<td>25:30</td>
<td>25:30</td>
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<td>600 ft</td>
<td>31:10</td>
<td>72</td>
<td>25.8565</td>
<td>31:10</td>
<td>31:10</td>
</tr>
</tbody>
</table>
### TABLE 3

**MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST**

<table>
<thead>
<tr>
<th>PIPE DIAMETER (INCHES)</th>
<th>MINIMUM TIME (SECONDS)</th>
<th>LENGTH FOR MINIMUM TIME (FEET)</th>
<th>TIME FOR LONGER LENGTH (SECONDS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>340</td>
<td>398</td>
<td>0.855 (L)</td>
</tr>
<tr>
<td>8</td>
<td>454</td>
<td>298</td>
<td>1.520 (L)</td>
</tr>
<tr>
<td>10</td>
<td>567</td>
<td>239</td>
<td>2.374 (L)</td>
</tr>
<tr>
<td>12</td>
<td>680</td>
<td>199</td>
<td>3.419 (L)</td>
</tr>
<tr>
<td>15</td>
<td>850</td>
<td>159</td>
<td>5.342 (L)</td>
</tr>
<tr>
<td>18</td>
<td>1020</td>
<td>133</td>
<td>7.693 (L)</td>
</tr>
<tr>
<td>21</td>
<td>1190</td>
<td>114</td>
<td>10.471 (L)</td>
</tr>
<tr>
<td>24</td>
<td>1360</td>
<td>100</td>
<td>13.676 (L)</td>
</tr>
<tr>
<td>27</td>
<td>1530</td>
<td>88</td>
<td>17.309 (L)</td>
</tr>
<tr>
<td>30</td>
<td>1700</td>
<td>80</td>
<td>21.369 (L)</td>
</tr>
<tr>
<td>33</td>
<td>1870</td>
<td>72</td>
<td>25.856 (L)</td>
</tr>
</tbody>
</table>
### TABLE 4

VACUUM TEST TIME TABLE

<table>
<thead>
<tr>
<th>DEPTH IN FEET</th>
<th>TIME IN SECONDS BY PIPE DIAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48&quot;</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
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<tr>
<td>8</td>
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<tr>
<td>16</td>
<td>40</td>
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<tr>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>24</td>
<td>60</td>
</tr>
<tr>
<td>*</td>
<td>5.0</td>
</tr>
</tbody>
</table>

*Add T times for each additional 2-foot depth.

(The values listed above have been extrapolated from ASTM C 924-85)
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS FOR
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL
SECTION 33 32 13.13 Add – PACKAGED UTILITY LIFT STATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes:

1. The furnishing, placing and construction of the lift station, miscellaneous structures, and appurtenances for the construction of new sanitary sewer systems as described and specified herein and elsewhere in other sections of the contract specifications and as shown on the Drawings. The work under this Item includes the furnishing of all materials, equipment, supplies and tools, the performance of all labor and services, and all incidentals necessary to complete the new installation in a neat and workmanlike manner. (See plan drawings and details for items to be installed as part of this contract, which includes but is not limited to items within the valve box, lift station manhole, hatch, vent pipe and electrical pit, frame and cover, drain pipe and conduit.)

2. Valves, gates and accessories for exposed, submerged and other types of piping for pump station.

3. Pipe and equipment hangers, supports, and associated anchors.

4. Equipment bases and supports.

5. Sleeves and seals.

6. Providing and installation of pumps and control equipment is not applicable to this contract; and will be provided included as part of a future project.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work related to this Section.

1.2 RELATED SECTIONS

Section 09 91 00.00 – Painting and Coating
Section 31 23 23.13 - Utility Backfill Materials
Section 31 23 35.00 - Excavation and Backfill for Utilities
Section 32 12 16.00, Asphalitic Pavement
Section 32 13 00.00, Concrete Pavement
Section 32 13 15.00 - Concrete for Utility Construction
Section 33 11 15.00 - Polyvinyl Chloride Pipe and Fittings
Section 33 11 16.00 – High Density Polyethylene (HDPE) Solid and Profile Wall Pipe
Section 33 11 51.00 - Polyethylene Wrap
Section 33 30 00.00 – General Sanitary Sewers
Section 33 31 00.00 – General Acceptance Testing for Sanitary Sewers
1.3 REFERENCES

A. Reference Standards: Comply as a minimum with applicable provisions and recommendations of the following:
   3. Anti-Friction Bearing Manufacturers Association (AFBMA).
   5. Institute of Electrical and Electronic Engineers (IEEE).
   8. Steel Structures Painting Council (SSPC).

B. Valves and Gates for Pump Station Reference Standards:
   2. AWWA C509 - Resilient Seated Gate Valves.
   3. AWWA C508 - Check Valves.
   4. AWWA C500 - Gate Valves.
   9. ASTM A194 - Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.

C. Pipe Hangers, Supports and Restraints Reference Standards:

1.4 MEASUREMENT AND PAYMENT

A. The furnishing, placing and construction of the lift station, miscellaneous structures, and appurtenances for the construction of new sanitary sewer systems shall be paid for on a lump sum basis. Payment will include furnishing all materials, equipment, supplies and tools, the performance of all labor and services, and all incidentals necessary to complete the new installation in a neat and workmanlike manner. No separate payment shall be made for access hatches, manholes, frames and covers, grates, drains valve and electrical boxes or structures, vent piping, etc., which items shall be considered incidental to the lift station.

B. No separate payment will be made for Valves and Gates for Pump Station under this Section. Include cost in lump sum price of the lift station.
C. No separate payment will be made for Pipe Hangers, Supports and Restraints under this Section. Include cost in lump sum price of the lift station.

D. No separate payment will be made for “Y’s” and “T’s” and standard stacks under this Section. Include cost in unit price of the lift station. The work includes excavation necessary to place such fittings, digging bell holes, hand grading for the bottom quarter of the pipe and hand tamping around the pipe.

E. No separate payment will be made for pavement, base, sidewalks and driveways, curbs and gutters, pipe sewers or pipe culverts, or any concrete or masonry structure removed under this Section. Include cost in unit price for work included as specified in Section 02 41 13.13 – Removal of Existing Pavement and Structures.

F. No separate payment will be made for pavement, pavement sections, base material, fill, or stone drainage layer replaced under this section. Include cost in unit price for work included as specified in Sections 32 11 33.00, 31 23 34.00, 32 11 33.00 and other applicable sections.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit, to the Port Construction Representative for approval, a complete list, including catalog data and descriptive matter, of all equipment he proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Construction Representative.

C. Valves and Gates:
   1. Shop Drawings:
      a. Submit for review detailed drawings, data and descriptive literature on valves and appurtenances, including:
         1) Dimensions.
         2) Size.
         3) Materials of construction.
         4) Weight.
         5) Protective coating.
         6) Actuator weight, where applicable.
         7) Calculations for actuator torque, where applicable.
         8) Wiring diagram, where applicable.
      b. Submit manufacturer's valve sizing calculations for verification of sizing for air release valves, air and vacuum valves, and surge relief valves.
   2. Manufacturer's Certifications: Submit manufacturer's certificates of compliance with ANSI, AWWA and other listed standards.
   3. Submit operation and maintenance data to the Port Construction Representative.
   4. Submit a detailed operation and maintenance manual for valves and appurtenances provided under this Section.

D. Pipe Hangers, Supports and Restraints
   1. As a minimum, submit the following items:
      a. A layout of the systems including location on fixed and movable joints.
b. Details of design and fabrication of joints.

c. Details of support brackets, cradles, pads, thrust resisting elements, and other supporting elements.

d. Other pertinent elements necessary for a complete installation.

e. Design calculations for submitted items.

E. Record Drawings: Submit record drawings under provisions of the General Conditions.

F. Operation and Maintenance Data: Submit operation and maintenance data to the Port Construction Representative.

G. Submersible Wastewater Pumps: Submittals for pumps is not required for this project. Providing and installation of pumps is not applicable to this contract; pumps will be provided as part of a future project.

1.6 PROTECTION

A. All work, equipment and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workmen. Work shall be properly protected to prevent obstruction or damage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be tightly covered and protected against dirt, water, and chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in perfect condition.

1.7 QUALITY ASSURANCE

A. All materials used shall be new, of high grade, and with properties best suited to the work required.

B. Manufacturer's Qualifications:

1. Valves and appurtenances provided under this Section shall be the standard product in regular production by manufacturers whose products have proven reliable in similar service for at least 5 years.

2. Insofar as possible all valves of the same specific type shall be the product of one manufacturer.

C. Substitution and Coordination Responsibility. The engineering design is based on a certain manufacturer's equipment.

1. If alternate hatches, manholes, guides or other equipment or piping for installation is utilized, the Contractor is responsible for submitting revised engineering design and drawings to ensure the proposed equipment compatible with the project, at no additional cost to the Port of Houston.

2. In order to ensure equipment compatibility, the Contractor shall name a pump manufacturer who shall be responsible for providing access frame, guides and other appurtenances for the specific pumps and motors and ensuring the function of the complete system in accordance with the intent of these Specifications. The named manufacturer shall be experienced in similar work.

3. Contractor shall retain overall responsibility for equipment coordination, installation, testing and operation.
1.8 DELIVERY, STORAGE AND HANDLING
A. Deliver equipment to site, all store and protect equipment under provisions of the General and Special Conditions.
B. Store all equipment off the ground in enclosed shelter.
C. The pump cable end shall be sealed with a high quality protective covering to make it impervious to moisture or water seepage from submersion or other causes prior to electrical installation.
D. Store valves and appurtenances off the ground in enclosed shelter.

PART 2 PRODUCTS

2.1 LIFT STATION
A. Lift station shall be constructed as shown on contract drawings, use material and equipment that conform to requirements specified in one or more of the following sections.
   1. Precast wet wells shall conform to specifications for Precast Reinforced Concrete Sections, ASTM Designation C478.
   2. Pump equipment, pipes, valves and fittings, refer to Paragraph 2.2, Submersible Wastewater Pumps.
   3. Refer to Contract Drawing C70-D01-002 sheets C-200 to C-203 for lift station No LS-4 basic design and layout.
B. Each pump will have separate discharge line from base elbow in wet well and through valve vault, discharge pipe shall be PVC DR 18 pressure pipe. These discharge lines shall be a four inches (4”) each with (A) common discharge of six inches (6”).
C. All pipes, valves, and fittings, unless otherwise stated, shall have flanged ends. All bolts, nuts, and washers used to connect these flange ends shall be of “Type 316 Stainless Steel.”
D. All pipe valves and fittings shall be installed, as indicated on ‘Contract Drawings.
E. Under no condition shall adapter flanges be permitted in wet well. Each horizontal discharge pipe shall be of one piece continuous length from connection with 90 degree bend in wet well to connection with long pattern “MH” sleeve in valve vault.
F. Accessories
   1. Frames and Covers:
      a. Halliday Products Series H2R, U.S. Foundry Series AHD or AHS, or approved substitution.
      b. For watertight service, Halliday Products Series H2W, U.S. Foundry Series THD or THS, or approved substitution.
      c. Aluminum access frames and covers shall be provided by the pump supplier. Fasteners, hinges and other hardware shall be type 316 stainless steel.
d. The frame shall be extruded aluminum with an integral seat and anchor flange. Door leafs shall be 1/4-inch thick aluminum floor plate reinforced to H-20 live load with 30 percent impact factor per AASHTO specifications.

e. The access door shall be equipped with a flush cast aluminum drop handle which does not protrude above the cover surface and an automatic hold open arm with a red vinyl release grip, that automatically holds the door in a 90 degree open position utilizing a stainless steel pin at the point where the door meets the hold open arm.

f. Hinges shall be stainless steel with stainless steel tamperproof hardware. Doors shall be equipped with a stainless steel, watertight slamlock with a threaded aluminum plug, removable outside handle and an inside release handle. The slamlock must latch onto a stainless steel catch bolted to the frame.

g. Doors shall also include a recessed padlock assembly that consists of a cast aluminum enclosure that is sized to restrict access by bolt cutters, a stainless steel staple for a padlock and a hinged stainless steel cover which does not protrude above cover surface.

h. Doors shall be equipped with stainless steel spring operators for lift assist and to retard downward motion. All parts of the spring operator shall be stainless steel or aluminum and to ensure visual inspection. Spring operators shall be open type. The spring operators shall be engineered and installed so that in the event of slamlock failure the door will remain closed. The force required to open any one door leaf shall be a minimum of 5 pounds and a maximum of 20 pounds.

i. Apply bituminous paint on all areas that come in contact with concrete.

j. Exposed frame and door surfaces shall be painted dark green as approved by the Port Construction Representative.

2. Bolts, Studs and Nuts:

a. All bolts, studs and nuts shall have American National form right-hand machine cut threads which shall be in conformity with the current ANSI B1.1, "Screw Threads", Coarse Thread Series, unless otherwise specified.

b. Bolt heads and nuts shall be semi-finished and shall be in conformity with ANSI B18.2, "Wrench-Head Bolts and Nuts and Wrench Openings", Heavy Series, unless otherwise specified. All nuts shall be hexagonal in shape.

c. Anchor bolts, flange bolts, studs and nuts shall be Type 316 stainless steel in conformity with ASTM A276.

2.2 VALVES AND GATES FOR PUMP STATION

A. Basic Requirements

1. Mark and identify valves in conformance with standards, these Specifications or to the manufacturer's standard.

2. Bolts, studs and nuts to be Type 316 stainless steel.
3. End connections of valves shall be flanged and drilled to ANSI Class 125 unless otherwise specified.

4. For handwheel operators on valves 4-inches or larger where located more than 5 feet above the operating floor, provide chain and chainwheel or extension operators. Use chainwheels fabricated of malleable cast iron with chain guides. Provide stainless steel chains of a length to extend to within 5 feet of the operating floor.

5. To exterior surfaces of valves, apply a shop coating in accordance with Section 09 91 00.00 – Painting and Coating.

B. Check Valves

1. Swing check valves 4-inches through 14-inches having a system pressure 30 psi or less, shall be air cushioned with side mount lever and weight. The valve shaft shall extend through both sides of the body with minimum shaft diameters equal to APCO Series 6000. The cushion shall be totally enclosed, swivel mounted at the bottom, and equipped with a micrometer air control valve and air breather filters. Valves shall be similar to APCO Series 6000, or approved substitution.

2. Swing check valves 10-inches through 14-inches having a system pressure greater than 30 psi shall be cushioned with side mount lever and weight. Valves shall be similar to APCO Series 6100, or approved substitution.

3. Swing check valves 16-inches and larger regardless of system operating pressure shall be cushioned with side mount lever and weight. Valves shall be similar to APCO Series 6100, or approved substitution.

4. Check valves of special design utilizing controlled closing of the disc, such as APCO Series 6000B (Bottom-Buffer) and Golden Anderson Fig. #25-DXH or approved substitution shall be used when specifically indicated on the Drawings. These valves are special valves used to control the surge pressure in the force main upon multiple pump shutdown during a power failure. Other surge control check valves utilizing ball or cone valve and power cylinder operator may also be used as approved by the Port Construction Representative.

5. All check valves shall have 300 series stainless steel hinge shafts, stainless steel body seats and stainless steel resilient seat retainer rings.

C. Gate Valves

1. Gate valves 4 inches through 14 inches: Solid wedge type, with resilient nitrile rubber (Buna- N) tapered seat. Provide valves complying with AWWA C-509. Acceptable manufacturers include Mueller, M&H, AVK, or approved substitution.

2. Gate valves 16 inches and larger: Solid wedge type with bronze to bronze seating surface. Provide valves complying with the AWWA C-500. Acceptable manufacturers include Mueller, M&H, AVK, or approved substitution.

3. Supply gate valves rated as 200 psi water working pressure with 400 psi hydrostatic test for structural soundness for 2 inches through 12 inches and 150 psi water working pressure with 300 psi hydrostatic test for structural soundness for sizes 14 inches through 30 inches.

4. Stems: OS&Y rising type manganese bronze having a minimum tensile strength of 60,000 psi, a minimum yield strength of 20,000 psi for valve sizes through 24 inches, and a minimum tensile strength of 80,000 psi, a minimum yield strength of 32,000 psi for valve sizes 30 inches and larger.

5. Valve Bodies: Cast iron conforming to ASTM A126 or ASTM A395. Fabricate internal trim parts of 300 series stainless steel.
D. Eccentric Plug Valves
1. Eccentric plug valves shall be the non-lubricated eccentric type with cast iron bodies, resilient-faced plugs or replaceable resilient seats in the bodies.

2. Operators: All valves for 4-inch and larger service shall have worm gear operators, nickel or stainless steel seats, and ANSI 125 psi flanged ends. Operators shall clearly indicate valve position. Operators on valves in submerged or buried service shall be lubricated and sealed to prevent entry of dirt and water into the operator.

3. Resilient facing shall be suitable for the intended service.

4. All shaft bearings shall be of stainless steel, furnished with permanently-lubricated bearing surfaces.

5. Valves up to and including 20 inches in size shall have an unobstructed port area of no less than 80 percent of the full pipe area, and not less than 70 percent for larger valves.

6. Eccentric plug valves shall be manufactured by Clow, De Zurik, Keystone, Val-Matic, or Victualic.

E. Sewage Air Release and Sewage Air and Vacuum Valves
1. Air Release and Air and Vacuum Valves: Provide when shown on Drawings.

2. Sewage Air Release Valve Design: Single float, single orifice, float operated with a compound lever mechanism to automatically release accumulated air and gases while the system is pressurized and operating.

3. Sewage Air and Vacuum Valve Design: Two float where the top float shuts off against the seat due to the lifting force of the bottom float as liquid enters the valve body. Once closed and pressurized the air and vacuum valve will not open to release air.

4. Fabricate valve body, cover and baffles of cast iron. Fabricate internal metal parts of stainless steel. Make valve seat of Buna-N nitrile rubber.

5. Fit valve with blow off valves, quick disconnect couplings and minimum 6-feet of hose to permit back flushing after installation with dismantling valve.

6. Provide air release valves equal to Series 400/450 SARV by APCO or Figure 925 by G.A. Induries.

7. Provide air and vacuum valves equal to Series 400 SARV by APCO. Figure 935 as manufactured by GA Industries, or Val-Matic.

F. Surge Relief Valves
1. Surge Relief Valves: Provide when shown on Drawings.

2. Operation: Surge relief valves shall protect piping systems from surges by opening quickly at a set pressure and throttling the flow to maintain line pressure at no more than 5 to 10 percent above the pressure setting indicated. Provide relief pressure adjustment by changing the tension on a spring holding the valve disc on its seat.

3. Valve Closing Control: By oil dashpots. Oil shall be drawn into the dashpot from a reservoir when the valve opens and return through a flow control valve when the relief valve closes.
4. Valve Construction: Fabricate valve bodies of cast iron with 300 series stainless steel seat rings. Provide seats that are renewable and resilient. Fabricate hinge shafts of stainless steel and the oil system of bronze. Unless otherwise indicated make the pressure setting 5 percent above normal line pressure.

5. Provide surge relief valves that are 90-degree elbow body configuration. Acceptable manufacturers include APCO series 3000, GA Industries 625-D, or approved substitution.

2.3 PIPE HANGERS, SUPPORTS AND RESTRAINTS

A. Hangers and Supports

1. For uninsulated lines 2 inches and less and for drainage and downspout lines provide hangers which are adjustable swivel ring type fabricated of malleable iron.

2. For uninsulated lines larger than 2 inches and for insulated lines, except drainage and downspout piping, provide adjustable clevis type hangers. Size hangers to allow insulation to extend unbroken through the hanger.

3. Fabricate hangers installed in valve vaults, wet wells, and other below grade areas of cadmium plated or stainless steel.

B. Inserts

1. Make inserts for individual hangers of galvanized malleable iron; include removable nuts held in place by V-type teeth on the insert body and nut. Make continuous-slotted channel inserts of galvanized steel with integral anchors at 6-inch centers. Provide factory finished steel snap-on cover plates on channel inserts between support attachments.

C. Expansion Bolts

1. Use expansion bolts for support which are stainless steel wedge type. Do not use expansion bolt anchors with lead.

D. Pipe Saddles

1. Fabricate pipe saddles of hot dip galvanized steel. Saddles for supporting pipe from the floor shall be at least 9 inches in length and as wide as the outside diameter of the pipe. Make a bearing support of 120 degrees. Mount saddles on concrete pads at least 2-inches high.

E. Framing Hangers

1. Use factory fabricated metal framing systems with factory applied primer paint as framing for wall type hangers, trapeze hangers, and tunnel stanchions. Attach supports to structures with inserts for new concrete, with surface mounting methods for masonry or existing concrete, and with welding or clamps for structural steel. Make pipe supports fabricated on the site of structural steel members with raw edges ground and dressed. Rest floor supports in areas with uncovered concrete floors on concrete pads not less than 2 inches high.
PART 3  EXECUTION

3.1  LIFT STATION:
A. For lift station, the first precast sections shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed so as to form an integral watertight unit.
B. The sections shall be uniformly supported by the base structure and shall not bear directly on any of the pipes. Precast sections shall be placed and aligned to provide vertical alignment with a ¼ inch maximum tolerance per five (5) feet of depth.
C. The completed wet well shall be rigid, true to dimensions, and water tight.
D. No fixed interior ladders shall be permitted in the wet well.
E. Interior of wet well shall have a plastic liners installed, refer to Section 33 42 70.00 - Plastic Liner for Large-Diameter Concrete Sewer and Structures.

3.2  VALVES AND GATES FOR PUMP STATION
A. Installation
   1. Install valves and specialties in accordance with manufacturer's written instructions to permit intended performance.
   2. Support and anchor valves and gates in accordance with Paragraph 3.4 - Pipe Hangars, Supports and Restraints.
   3. Eccentric plug valves shall be installed according to the following:
      a. Position the valves with the stem in the horizontal direction.
      b. In horizontal pipelines, position the valves so that the plug swings upward when opening to permit flushing of solids.
      c. Orient the valves to prevent the valve bodies from filling up with solids when closed; however, orient the valves such that the pressure differential forces the plug against the seat in cases where the pressure differential across a closed valve will exceed 25 psi.
B. Painting
   1. Paint valves and specialties in accordance with applicable AWWA standards and with Section 09 91 00.00 – Painting and Coating.
C. Testing
   1. Test valves using a hydrostatic pressure test in accordance with AWWA C-600.
   2. Test valves and specialties in place. Correct defects in valves, specialties or connections.

3.3  PIPE HANGERS, SUPPORTS AND RESTRAINTS
A. Installation
   1. Hang piping inside structures supported from the floor or racked adjacent to walls.
2. Provide inserts cast in concrete walls or slabs for hanging and supporting pipe. If materials not galvanized or cadmium plated, paint them with primer before installation.

3. Design fabricate, and install support components in general conformance with Sections 120 and 121 of ANSI B31.1, Power Piping, except as modified in this Section.

B. Pipe Hangers and Supports

1. Support, brace, and anchor interior piping to prevent movement in any direction because of pressure, temperature, flow, or water hammer, except at properly located expansion joints and fittings.

2. Provide two pipe guides on each side of expansion joints at which pipe movement occurs. The first guide shall be not more than 4-pipe diameters from the joint and the second not more than 14 diameters. Provide additional guides as required to maintain pipe alignment, spaced as required for the pipe size, fluid pressure and temperature inside the pipe, and as recommended by the expansion joint manufacturer or as shown.

3. Maximum support spacing and hanger rod sizes for metal pipe containing liquids are as follows:

<table>
<thead>
<tr>
<th>Nominal Pipe Size (Inches)</th>
<th>Support Spacing (Feet)</th>
<th>Rod Diameter in Inches</th>
<th>One Rod</th>
<th>Two Rods</th>
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<td>3/8</td>
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<td>24</td>
<td>17</td>
<td>1-1/8</td>
<td>7/8</td>
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4. For valves 4 inches and larger in unburied horizontal lines support the valve on both sides when located within 18 inches of the valve or meter. Provide additional supports where required so that piping loads do not place damaging stresses on supports, valves, and equipment. Where necessary, block up pipe at supports to permit installation of insulation.

5. Support unburied horizontal runs of rubber hose and non-metallic pipe for the entire length by means of troughs consisting of structural steel channels or angles supported at not more than 10-foot intervals.
6. Support piping not included in the foregoing tabulation as indicated or in accordance with the pipe manufacturer's recommendations, if not indicated.

7. Anchor buried pressure pipe at each fitting causing a change in direction of 10 degrees or more. Concrete thrust blocks or other restraining devices in any satisfactory combination may be used. Submit the details of the method proposed for use, together with design calculations, to the Port Construction Representative before installation.

3.4 MISCELLANEOUS AND SPECIAL CONCRETE SEWER STRUCTURE:
A. All miscellaneous and special reinforced concrete drainage structures shall be constructed of materials indicated on the Drawings and specified hereinbefore for sewers, manholes, and inlets, to location, line and grades and in accordance with details shown on the Drawings. Excavation and backfill methods shall be in accordance with applicable specifications provided hereinbefore for concrete sewers, inlets and manholes.

3.5 SPECIAL-STACKS, Y'S OR T'S:
A. Description:
   1. The Contractor shall, unless otherwise ordered by the Port Construction Representative, place stacks, Y's or T's in the sewer at suitable locations to provide for connection for each building or other potential building site.
   2. Where the location for these specials are not indicated on the plans, the Contractor shall obtain the approval of the Port Construction Representative for the locations selected.
   3. Any required special ordered by the Port Construction Representative omitted by the Contractor during construction of the sewer shall be corrected by the Contractor at no extra expense to the Port of Houston Authority.
   4. Stacks: This Item shall consist of construction of stacks on sewers where the top of the sewer is greater than eight feet below the surface of the ground. Construction of stacks shall conform with Drawings.
   5. 1/8 Bends and ¼ Bends: This Item shall consist of furnishing, laying and jointing sewer pipe 1/8 bends and ¼ bends in an existing open trench or other accessible location including the work of connecting with existing pipes at either or both ends.

B. Materials:
   1. "Y" and "T" fittings on pipe sewers shall be made at the pipe factory. The run of the pipe shall be of the same class of pipe as that used in the sewer. The branch shall be, unless otherwise ordered, six inch terminating in a hub. All pipe and fittings used in specials shall conform to the ASTM Specifications for the class of pipe and fittings required as given elsewhere herein.
   2. "Y" or "T" branches on pipe 15" or larger may be cemented on at the job site but holes in the pipe and ends of the branches shall be cut at the factory to an accurate fit.

C. Construction methods:
   1. "Y"s" and "T"s" ordered placed in pipe sewers and "T's" in pipe sewers at the base of the stacks shall be placed at the time the pipe is laid. "T's" and stacks on monolithic sewers and stacks on pipe sewers shall conform to the details in the drawing herein. The top and branch opening of stacks and the branch opening of
“Y’s” and “T’s” shall be plugged with a standard pipe plug, placed with cold joint compound or rubber gaskets. Specials shall not be covered until their location has been recorded by the Port Construction Representative.

2. The branches of “Y’s” and “T’s” shall be closed with a standard pipe plug cemented lightly in place in a manner that will exclude water and dirt, but permit removal without damage to the bells.

3.6 REMOVAL AND REPLACEMENT OF STREET BASE AND SURFACE:

A. Description: The work to be performed under this Item of the Technical Specifications shall consist of the removal, salvaging, and/or disposal of excess material and the replacing of base and surface removed in connection with the construction of sewers and appurtenances.

B. Construction Method:

1. Where sewer construction involves the cutting of a concrete, or concrete base street, the pavement shall be cut two feet wider than the width of trench necessary to install the sewer in a manner that will provide a minimum of one foot of undisturbed subgrade on each side of the trench to provide additional support for the slab when replaced. After the trench has been backfilled and compacted to the satisfaction of the Port Construction Representative the area on which the concrete slab is to be replaced shall be fine graded to provide the minimum thickness of slab as set out on Drawings. Reinforcing steel of the size, length and at the spacing shown shall be furnished and installed in accordance with Drawing.

2. Use of drop hammer for breaking concrete pavement or base for removal will not be permitted. Concrete pavement shall be furnished and placed in accordance with the Section 32 13 00.00, Concrete Pavement.

3. Where the pavement consists of a concrete base with asphalt surfacing, the new concrete base shall be surfaced with not less than 1-1/2" of hot mix asphalt concrete surfacing mixed and placed in accordance with the Section 32 12 16.00, Asphaltic Pavement and special provisions thereto, if any.

4. Where the installation of the sewer involves cutting an existing flexible base, the Contractor shall, when ordered by the Port Construction Representative remove and store excavated base and bituminous surface material within the limits designated by the Port Construction Representative. The Contractor shall take all necessary precautions to prevent mixing foreign materials with the base material during the entire salvaging operation. After the trench has been backfilled, the salvaged material shall be replaced in layers not to exceed six (6") inches in depth, loose measurement, and each layer compacted by wetting and rolling with pneumatic tires until no further settlement is noticeable.

5. Where additional or new base material is required, and its placing is authorized by the Port Construction Representative, it shall be furnished in accordance with the paving specifications covering the type material set out in the proposal for flexible base replacement.

6. Where the existing flexible base has been surfaced with a bituminous surfacing, the base replaced under this Item shall be surfaced in accordance with Section 32 12 16.00, Asphaltic Pavement.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 34 00.00 Add – SANITARY UTILITY SEWERAGE FORCE MAINS

PART 1  GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this section includes sanitary utility sewerage force mains.

1.2 RELATED SECTIONS

Section 01 57 25.00 - Ground Water and Surface Water Control.
Section 03 10 00.00, Concrete Formwork
Section 03 20 00.00, Reinforcing Steel
Section 31 23 35.00 - Excavation and Backfill for Utilities.
Section 32 12 16.00, Asphalitic Pavement
Section 32 13 13.00, Concrete Pavement
Section 33 08 40.00, Frames, Grates, Rings and Covers
Section 33 11 15.00, Polyvinyl Chloride Pipe and Fittings
Section 33 11 16.00 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe
Section 33 11 51.00 - Polyethylene Wrap
Section 33 30 00.00 – General Sanitary Sewers
Section 33 31 00.00 - Acceptance Testing for Sanitary Sewers
Section 33 32 13.13 - Packaged Utility Lift Station
Section 33 42 70.00, Plastic Liner for Large Diameter Concrete Sewers and Structures

1.3 REFERENCES

A. ACI 318 - Building Code Requirements for Reinforced Concrete.

B. ASTM D 696 - Standard Test Method for Coefficient of Linear Expansion of Plastics Between -30 degrees C and 30 degrees C.
C. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.


G. ASTM D 2992 - Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe and Fittings.


K. Uni-Bell UNI-B-3 Polyvinyl Chloride (PVC) Pressure Pipe (complying with AWWA C 900).

1.4 MEASUREMENT AND PAYMENT

A. Installation of force main pipe by open-cut or augered with or without casing shall be paid for on a linear foot basis. Measurement will be taken along the centerline of pipe from end to end. Payment will be made for each foot of force main installed, complete in place, including pipe, excavation, bedding, backfill and special backfill, shoring, earthwork, connections to existing manholes, grouting and pipe and accessories.

B. No separate payment will be made for Acceptance testing of force mains under this Section. Include cost in unit price of force main pipe. Force mains shall be tested in accordance with the requirements of Paragraph 3.3, Hydrostatic Testing and Paragraph 3.4, Pigging Test of this Section.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit proposed methods, equipment, materials, and sequence of operations for force main construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Submit shop drawings and design calculations for joint restraint systems using reinforced concrete encasement of pressure pipe and fittings.

D. Submit qualifications, proposed methods, equipment, materials, and sequence for acceptance testing of the pipeline. Submit evidence of experience with pipeline proving by pigging for at least three projects of equal or greater scope; project list shall include dates, size and length of pipe, location, owner name, contact person, and telephone.
number. Provide certificate of training by the manufacturer of the pigging equipment being used.

PART 2 PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Conform to requirements of Section 33 50 10.00 - Ductile-Iron Pipe and Fittings.

2.2 POLYETHYLENE PIPE AND FITTINGS

A. Conform to requirements of Section 33 11 16.00 - High Density Polyethylene Solid and Profile Wall Pipe

2.3 THRUST RESTRAINT

A. Unless otherwise shown on the Drawings, provide concrete thrust blocking for force mains up to 12-inches in diameter, to prevent movement of buried lines under pressure at bends, tees, caps, valves and hydrants. Blocking shall be Portland cement concrete, as specified in Section 32 13 15.00 - Concrete for Utility Construction. Place concrete in accordance with details on the Drawings. Place thrust blocks between undisturbed ground and the fittings. Anchor fittings to thrust blocks so that pipe and fitting joints are accessible for repairs. Concrete shall extend from 6 inches below the pipe or fitting to 12 inches above.

B. For force mains larger than 12 inches in diameter, and where indicated on the Drawings, provide restrained joints conforming to the requirements of the force main pipe material specifications. Restrained joints shall be installed for the length of pipe on both sides of each bend or fitting for the full length shown on the Drawings.

C. Horizontal and vertical bends between zero and 10 degrees deflection angle will not require thrust blocks or harnessed or restrained joints.

D. Horizontal and vertical bends between 10 degrees and 90 degrees deflection angle shall have thrust restraint as shown on the Drawings.

E. Provide thrust restraint at tees, plugs, blowoff drains, valves, and caps, as indicated.

F. Reinforced concrete encasement of force main pipe and fittings may be used in lieu of manufactured joint restraint systems. Alternate joint restraint systems using reinforced concrete encasement shall conform to the following design requirements.

1. Design calculations shall be performed and sealed by a Professional Engineer licensed in the State of Texas.

2. Design calculations shall be based upon soil parameters quantified in the geotechnical report for the site where the alternative thrust restraint system is to be installed. If data is not available for the site, use parameters recommended by the geotechnical engineer.

3. The design system pressure shall be the specified test pressure.

4. The following safety factors shall be used in sizing the restraint system:
a. Apply a factor of safety equal to 1.5 for passive soil resistance.

b. Apply a factor of safety equal to 2.0 for soil friction.

5. The encasement shall be contained entirely within the standard trench width and terminate on both ends at a pipe bell or coupling.

6. Concrete encasement reinforcement steel shall be designed for all loads, including internal pressure and longitudinal forces. Concrete design shall be in accordance with ACI 318.

PART 3  EXECUTION

3.1 PIPE INSTALLATION BY OPEN-CUT

A. Perform excavation, bedding, and backfill in accordance with Section 31 23 35.00 - Excavation and Backfill for Utilities.

B. Wrap ductile-iron pipe and fittings with polyethylene wrap in accordance with requirements of Section 33 11 51.00 - Polyethylene Wrap. Polyethylene wrap shall not be installed on ductile iron pipe protected by a cathodic protection system.

C. Install pipe in accordance with the pipe manufacturer's recommendations and as specified in the following paragraphs.

D. Install pipe only after excavation is completed, the bottom of the trench is fine graded, bedding material is installed, and the trench has been approved by the Port Construction Representative.

E. Install pipe to the line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in the trench so the interior surfaces of the pipe follow the grades and alignment indicated. Provide bell holes where necessary.

F. Install pipe with the spigot ends toward the direction of flow. Form a concentric joint with each section of adjoining pipe so as to prevent offsets.

G. Keep the interior of pipe clean as the installation progresses. Where cleaning after laying the pipe is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull it forward past each joint immediately after the joint has been completed. Remove foreign material and debris from the pipe.

H. Provide lubricant, place and drive home newly-laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by the Port Construction Representative.

I. Keep excavations free of water during construction and until final inspection.

J. When work is not in progress, cover the exposed ends of pipes with an approved plug to prevent foreign material from entering the pipe.

K. Where sanitary sewer force main is to be installed under an existing water line with a separation distance of less than 2 feet, install one full joint length of pipe centered on the water line and maintain a minimum 6-inch separation distance.
3.2 PIPE INSTALLATION OTHER THAN OPEN-CUT
A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification section of augering or tunneling work.

3.3 HYDROSTATIC TESTING
A. After the pipe and appurtenance have been installed, test line and drain. Prevent damage to the Work or adjacent areas. Use clean water to perform tests.
B. The Port Construction Representative may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.
C. Test pipe in the presence of the Port Construction Representative.
D. Test pipe at 150 psig or 1.5 times design pressure of the pipe, whichever is greater. Design pressure of the force main shall be the rated total dynamic head of the lift station pump.
E. Test pipe at the required pressure for a minimum of 2 hours according to requirements of Uni-B-3.
F. Maximum allowable leakage shall be as calculated by the following formula:

\[ L = \frac{(S)(D)(P^{0.5})}{133,200} \]

Where:
- \( L \) = Leakage in gallons per hour.
- \( S \) = Length of pipe in feet.
- \( D \) = Inside diameter of pipe in inches.
- \( P \) = Pressure in pounds per square inch.

G. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by the Port Construction Representative.
H. Plug openings in the force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering the tested pipeline.

3.4 PIGGING TEST
A. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.
B. Pigs: Provide proving pigs manufactured of an open-cell polyurethane foam body, without any coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of the nominal cross-sectional area of the pipe. Pigs shall be able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to the force main being tested.
C. Test Execution: Pigging test shall be conducted in the presence of the Port Construction Representative. Provide at least 48-hours notice of scheduled pigging of the force main prior to commencing the test.

END OF SECTION
PORT OF HOUSTON AUTHORITY  
TECHNICAL SPECIFICATIONS FOR  
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL  
SECTION 33 40 00.00 Add - STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes the furnishing, placing and construction of storm sewers, manholes, inlets, miscellaneous drainage structures, outfall structures and appurtenances for drainage of pavements, roadways, railroad track areas, ditches and other surface areas, including the construction of new storm drainage systems and/or the extension or modification of existing storm drainage systems, as described and specified herein and elsewhere in other sections of the contract specifications and as shown on the Drawings. The work under this item includes the furnishing of all materials, equipment, supplies and tools, the performance of all labor and services, and all incidentals necessary to complete the new installation or modification of existing installations in a neat, substantial and workmanlike manner.

B. Storm sewers shall have precast reinforced concrete pipe, corrugated metal pipe, reinforced concrete box sewer or cast iron pipe, or a combination of these, as indicated and detailed on the drawings and in accordance with the specifications.

C. Connections to existing storm sewers shall be made as shown by the Drawings and as specified.

1.2 RELATED SECTIONS

A. 01 57 25.00 - Ground Water & Surf Water Control
B. 03 21 00.00 - Reinforcing Steel
C. 03 30 00.00 - Cast-in-Place Concrete
D. 31 23 23.13 - Backfill Materials
E. 31 23 35.00 - Excavation and Backfill for Utilities
F. 31 32 13.17 - Cement Stabilized Sand Fill
G. 32 13 20.00 - Concrete Joints and Embedded Items
H. 33 11 15.00 - Polyvinyl Chloride Pipe
I. 33 42 13.13 - Corrugated Metal Pipe
J. 33 42 16.13 - Reinforced Concrete Pipe

The requirements of Division 01 and general and special conditions of this contract apply to this work.

1.3 REFERENCES

A. ASTM A536 – Ductile Iron Castings.
B. ASTM A760 – Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
C. ASTM A761 – Steel Galvanized, Corrugated Structural Plates and Fasteners for Pipe, Pipe-Arches, and Arches.
D. ASTM A762 – Precoated (Polymeric) Galvanized Steel Sewer and Drainage Pipe.
E. ASTM A 798 – Installing Factory-Made Corrugated Steel Sewer Pipe.
F. ASTM A849 – Post-Coated and Lined (Bituminous or Concrete) Corrugated Steel Sewer and Drainage Pipe.
G. ASTM A885 – Steel Sheet, Zinc and Aramid Fiber Composite Coated for Corrugated Steel Sewer, Culvert, and Underdrain Pipe.
H. ASTM B745 – Corrugate Aluminum Alloy Culvert Pipe.
I. ASTM C14 – Concrete Sewer, Storm Drain, and Culvert Pipe.
J. ASTM C76 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
L. ASTM C507 – Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.
M. ASTM C655 – Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe.
N. ASTM C1433 – Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.
O. AASHTO M190 – Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
P. AASHTO M196 – Corrugated Aluminum Alloy Culverts and Underdrains.

1.4 MEASUREMENT AND PAYMENT

A. Subject to Section III, Storm Sewers - Measurement:

1. All concrete pipe sewers, Ultra-flow pipe, trench drains and reinforced concrete box sewers constructed in accordance with the above specifications and accepted by the Port Construction Representative shall be measured by the linear foot of the size installed, completed and accepted; including timber bents and associated appurtenances.

2. The length of sewer mains and laterals will be measured between centers of manholes where the installation involves the connecting of sewer into a manhole at each end of the line being measured.

3. When the installation involves a connection to an existing stub, the measurement shall be made from the end of the stub to the center of the manhole on the work being measured. There will be no separate measurement for removal of plugs.

4. Storm sewer leads connecting an area-type inlet or junction box with a manhole shall be measured from the center of the manhole to the outer edge of the inlet or junction box.

5. Storm sewer leads connecting trench drain with a manhole shall be measured from the center of the manhole to the nearest/outer edge of the trench drain grate.

6. Storm sewer leads and laterals connecting trench drain with area inlet or junction box shall be measured from the outer edge of the inlet or junction box to the nearest/outer edge of the trench drain grate.

B. Manholes, Area Drains, and Other Drainage Structures - Measurement:

1. Manholes shall be measured per each: completed and accepted in accordance with Drawings; one for each manhole of each type constructed.

2. Area Drain Inlet Structures shall be measured per each: completed and accepted in accordance with Drawings; one for each inlet of each size considered.

3. Other drainage structures including junction box and concrete collar shall be measured per each: completed and accepted in accordance with Drawings; one for each complete structure.
C. Monolithic Concrete Trench Drains - Measurement: The length of the concrete trench drains for payment will be measured per linear foot from indicated upstream flowline to downstream termination of trench. Concrete structure beyond the upstream end of the trench and stubs into junctions and/or manholes will not be measured for payment but shall be considered subsidiary to the unit price for trench drain.

D. Storm Sewers - Payment:
1. All sewer mains, laterals, stubs, and inlet leads, measured as set out above, shall be paid for at the unit price bid by the Contractor for "Reinforced Concrete Pipe" and/or "Reinforced Concrete Box Sewer" per linear foot complete in place, of the type and size constructed, completed and accepted.
2. The unit price bid for each of these items for storm sewers shall be full compensation for furnishing all labor, material, equipment, hauling, excavation, pumping and dewatering, shaping of trench bottom, bedding and backfilling, removal of plugs, disposal of surplus excavated material, and all incidentals necessary to furnish storm sewers complete in place and accepted.

E. Manholes, Inlets, and Other Drainage Structures - Payment:
1. All manholes shall be paid for at the unit price bid for each manhole of each type furnished. The unit price bid for "Manholes" shall be full compensation for furnishing all labor, all materials, including frame and cover castings and manhole steps, concrete mortar and brickwork, pumping, excavation, hauling, and disposal of surplus earth; pumping and dewatering; foundation preparation; bedding, backfilling and tamping; connection of leads, stubs and sewer lines to the manhole; and all other incidentals necessary to complete the manhole. There will be no separate payment for extra depth on manholes.
2. All Area Drain Inlet Structures shall be paid for at the unit price bid for each inlet of each type furnished. The unit price bid for inlets shall be full compensation for furnishing all labor, tools and equipment; all materials, including cast iron grate frames and grates, concrete, mortar, and brick work; pumping, excavation, hauling and disposal of surplus excavated material, backfilling and compacting; and all other incidentals necessary to complete the inlet. No separate payment shall be made for grate frames and grates, raising inlets; such work shall be considered incidental to finished grading.
3. Payment for Trench Drain by the linear foot of the size installed, completed and accepted. No separate payment shall be made for the construction of the sleeved 2” diameter weep hole, Trench Gate slot and the ¾-inch thick polyethylene trench gates, or frame and grate; these items shall be incidental to the trench drain.
4. Drainage structures other than inlets and manholes shall be paid for at the unit price bid for each structure of each type furnished; including junction box structure and concrete collar. Payment for frames, grates and covers shall be considered incidental to the storm sewer structure. The unit price bid shall be full compensation for all labor, material, equipment, tools, frames, grates, covers and incidentals to complete each separate structure.
5. When rip rap is indicated adjacent to a storm sewer structure, payment for rip rap will be made in accordance with Section 31 37 16.13 - Riprap, at the type and limits as indicated in Plans.
6. Where called for on the plans, payment shall be made on an Each basis for new grate to replace manhole cover on existing structures. Price shall include all work necessary, including frame or modifications needed.

F. Monolithic Concrete Trench Drains - Payment: The cost of furnishing and placing the monolithic concrete trench drain with frames, grates, and fin drain with weep holes, shall be paid at the Contractor’s unit price bid for the Bid item “Concrete Trench Drain” per linear foot of trench drain constructed and measured as labor, materials, backfilling
(including foundation materials and installation), bedding and all other incidentals necessary to complete the concrete trench drain and cover.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. The Contractor shall submit to the Port Construction Representative for approval a complete list, including catalog data and descriptive matter, of all products and equipment the Contractor proposes to furnish, shop drawings of equipment, and piping details as may be required by the Port Authority.

C. At the Contractor’s option, precast structures meeting the design intention of the detailed cast-in-place structures may be submitted for review. Documentation for precast structures shall include calculations and detailed drawings indicating structure meets the intended loadings. Precast designs shall be sealed by an Engineer licensed in the State of Texas.

1.6 QUALITY ASSURANCE

All work, equipment and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workmen. Work shall be properly protected to prevent obstruction or damage. All pipe openings shall be closed with caps or plugs during installation. All equipment shall be tightly covered and protected against dirt, water, chemical and mechanical injury. At the final completion, all work shall be thoroughly cleaned and delivered in a condition acceptable to the Port Construction Representative.

PART 2 PRODUCTS

2.1 Material

A. Cast Iron Drain Lines: All cast iron pipe drain lines designated on the drawings as “Cast Iron Pipe (CI 150)” shall be AWWA Class 150 bell and spigot cast iron water pipe conforming to American Water Works (AWWA) Specification C106 (ASA A21.6) or AWWA Specification C108 (ASA A21.8), with bell and spigot fittings conforming to American Standards Association (ASA) Specification A21.10, latest revisions.

B. Polyvinyl Chloride Pipe: Conform to the requirements of Section 33 11 15.00 - Polyvinyl Chloride Pipe, and as shown on the Drawings. PVC pipe may not be used in petroleum-contaminated areas or in augering/jacking applications.

C. Reinforced Concrete Pipe: Conform to the requirements of Section 33 42 16.13 - Reinforced Concrete Pipe, and as shown on the Drawings.

D. Corrugated Metal Pipe:
   1. All corrugated metal drainage pipes and components shall conform to the requirements of Section 33 42 13.13 – Corrugated Metal Pipe.
   2. Band couplers shall be used to join sections of corrugated pipes shown on the Drawings. Couplers shall be fabricated from the same materials as pipe. The bands may be not more than three nominal sheet thicknesses lighter than the thickness of the pipe to be connected and in no case lighter than 0.052 in. Coupler bolts shall be furnished galvanized. Except as herein specified, band couplers shall conform to ASTM A760, latest revision.
   3. All corrugated metal pipe and band couplers shall be fully bituminous coated. Bituminous coating shall conform to the A.R.E.A. Specifications for Bituminous Coated Corrugated Metal Pipe and Arches, latest revision.

E. Precast Reinforced Concrete Box Sewers:
   1. Box sewer sections shall conform to ASTM C789 or C850, as indicated on the Drawings.
2. Pipe and boxes shall be machine-made or cast by a process that will provide for uniform placement of concrete in forms and compaction by mechanical devices to produce dense, structurally sound concrete.

F. Concrete: Except as noted on the Drawings or provided otherwise in the Technical Specifications, concrete for reinforced concrete box sewers, inlets, junction boxes, manholes and other drainage structures shall be Class C concrete as described in Section 03 30 00.00 – Cast-in-Place Concrete. The materials, proportioning, testing, mixing, placing, forms and finishing shall be in accordance with the requirements of the aforementioned Section.

G. Reinforcing Steel: Reinforcing steel bars where indicated on the Drawings for storm drainage structures, including reinforced concrete box sewers, and special drainage structures, shall be new billet steel reinforcing bars conforming to the requirements of Section 03 21 00.00 - Reinforcing Steel. The fabrication, splicing, placing and support of such bars shall be in accordance with the requirements of the aforementioned Section.

H. Brick for Inlets, Manholes and Other Drainage Structures: Brick, where permitted to be used as noted on the Drawings, shall be made from clay or shale in accordance with ASTM C 32, Grade SS or SM, except that not more than 16% maximum individual brick absorption will be permitted.

I. Cast Iron Frames and Covers: Cast iron for manhole frames and covers and inlet grates, frames and beams, shall conform to the shape and dimensions shown on the Drawings and shall be clean and perfect, free from sand or blow holes or other defects. Holes in cover must be free from plugs and shall be clean. Bearing surfaces of manhole frames and covers are to be machined so that even bearing may be had in any position in which manhole cover is seated in the frame. Cast iron shall conform to ASTM Specification A48 for Class 30 Gray Cast Iron.

J. Concrete Trench Drains:

1. Concrete Trench:
   a. Concrete for the concrete trench shall be Class E in accordance with Section 03 30 00.00 – Cast-in-Place Concrete. Expansion joints shall be placed at locations and in accordance with details shown on the Drawings. The expansion joint filler shall be pre-form bituminous fiber seal material meeting the requirements of ASTM D 1751, Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
   b. Joint sealing compound shall be in accordance with Section 32 13 20.00 - Concrete Joints and Embedded Items.
   c. The area from which soil is excavated adjacent to the walls of the trench from bottom of concrete to bottom of pavement, as shown on the Drawings, shall be backfilled with cement stabilized sand, furnished and placed in accordance with Section 31 32 13.16 - Cement Stabilized Sand Fill.

2. Grates and Frames:
   a. Grates and frames shall be heavy Duty Trench Grate and Frame, ABT XHD SYSTEM TR 18 or Port Construction Representative approved substitution. Dimensional tolerances for the placement of frames and grates shall be as designated on the Drawings, grates to be fixed to frame with alternating fixed anchor pin and removable anchor pin in accordance with the manufacturers recommendations, and installations not meeting such tolerances will be rejected.
b. The Contractor shall furnish the Port Construction Representative with authentic, legible mill test reports for all the trench castings. Trench castings shall not be used on Port Authority work unless laboratory tests made by a laboratory selected by the Port Construction Representative determine that the cast iron conforms to the above ASTM Specifications. The cost of such tests shall be paid by the Contractor. In the event laboratory tests are used in lieu of mill test reports, acceptance of the ductile iron material by the Port Construction Representative will be made on the basis of acceptable tests results of castings.

c. In addition to the above, approximately two grates and frames shall be selected by the Port Construction Representative at random from the castings furnished and not yet installed by the Contractor. Such grates and frames shall be tested to determine compliance with these Specifications. Such test shall be performed by a commercial laboratory employed and paid by the Port of Houston Authority. Further laboratory testing necessitated by the rejection of castings shall be paid for by the Contractor. All test specimens shall be provided by the Contractor at his expense.

K. Ductile Iron Frames and Covers: Ductile iron for manhole frames and covers and inlet grates, frames and beams shall conform to the shape and dimensions shown on the Drawings and shall be clean, free from sand or blow holes or other defects. Holes in covers must be free from plugs and shall be clean. Bearing surfaces of manhole frames and covers are to be machined so that even bearing may be had in any position in which manhole cover is seated in the frame. Ductile iron shall conform to ASTM A536.

PART 3 EXECUTION

3.1 Cast Iron Drainage Lines

A. Trenching and Backfill: The trenching and backfill for cast iron drainage pipe and fittings shall be done in accordance with requirements for excavation, preparation and backfill of trenches for reinforced concrete sewers under this Specification.

B. Joints: All C.I. 150 cast iron drainage pipe shall be caulked with dry oakum packing, run full with molten lead in one continuous pour, and thoroughly caulked and faced. Not less than twelve ounces of lead for each inch of diameter of pipe shall be used.

C. Connection to Concrete Pipe: Cast iron drainage pipe shall be connected to concrete sewer pipe in accordance with details shown on the Drawings.

D. Sleeves: Furnish and install sleeves at drainage pipe and/or fittings through concrete walls, slabs or beams in accordance with locations and details shown on the Drawings.

3.2 Reinforced Concrete Sewer Pipe

A. General:

1. The Contractor shall take special care to locate only Class IV pipe under all railroads for not less than the distances shown on the Drawings. Where no distance is shown, Class IV pipe shall extend under railroad tracks to not less than ten feet from centerline of track as measured at right angles to track.

2. Elliptically reinforced pipe shall be carefully laid with elliptical reinforcement closest to outside of the pipe at sides of pipe on the pipe’s horizontal axis.

3. No pipe shall be laid that has spalls or cracks on either end that would affect the tightness of the joint. The pipe must be stamped by a competent testing laboratory as evidence of compliance with the ASTM Specifications.

4. Install in accordance with pipe manufacturer’s recommendations and as specified in this Section.
B. Laying Pipe:

1. All sewers shall be laid true to line and grade with bells upgrade. The sections of the pipe shall be so laid and fitted together that when complete the sewer will have a smooth and uniform invert. The pipe shall be kept thoroughly clean so that jointing compound will adhere. Each pipe shall be inspected for defects before being lowered into the trench.

2. The excavation of trenches shall be fully completed at a sufficient distance, not exceeding 100 feet unless permitted by the Port Authority, in advance of the laying of the sewer to maintain a true alignment.

3. The exposed ends of all pipes shall be fully protected with a board or other approved stopper to prevent earth or other substances from entering the pipe. The interior of the sewer shall be carefully cleaned from all dirt, cement, or superfluous material of every description as the work progresses.

4. Install pipe to line and grade indicated on Drawings. Place pipe so that it has a continuous bearing of barrel on bedding material with no voids, is laid in trench so interior surfaces of pipe follows grades and alignments indicated. The Contractor will not be authorized to put in siphons or other structures which will allow the sewer to deviate from the given line without the written authority of the Port Construction Representative.

5. The pipes shall be laid with the spigot end downstream entering the bell to full depth and in such manner as not to drag earth into the annular space for the grouting of the joints.

C. Pipe Bedding:

1. The pipe shall be bedded in the trench as described herein and as shown on the Drawings. In every case where trenches have been excavated below the specified depth for bedding, the depth of bedding below pipe shall be increased to fill the over-depth space.

2. Except under railroad tracks, bedding shall be done in the following manner and as shown by Pipe Installation in the Drawings:
   a. The bottom of the trench for the pipe barrel shall be excavated to a line parallel to the flow line of the pipe and to a depth of not less than three inches below the bell when bell and spigot is used, and not less than five inches below the outside of the pipe barrel when tongue and groove pipe is used. The cement stabilized sand shall be spread over the entire bottom of the sewer trench to the flow-line grade of the sewer after which a subgrade conforming to the outside shape of the pipe shall be prepared. Cement stabilized sand shall be used to backfill the sewer trench up to the horizontal diameter of the pipe after the pipe has been installed or above as shown in the Drawings. The cement stabilized sand for pipe bedding and pipe trench backfill shall be composed of course-grained sand and not less than one and one-half sacks of Portland cement per cubic yard of mixture, mixed in a concrete type mixer. This material cannot be used after it loses its moisture content or dries out. It shall be rodded in the trench and the area between the horizontal diameter of the pipe and bottom of the trench shall be free of cavities.
   b. Loose earth backfill material shall be placed to a depth of six inches above the pipe before ceasing operations for the day. No backfill in excess of six inches above the top of the pipe shall be placed on the same day the pipe is laid and bedded. Backfill above the pipe shall be done as prescribed for backfilling reinforced concrete drainage sewers in Section 31 23 35.00 - Excavation and Backfill for Utilities.
c. Where the trench bottom seeps water to the extent soft unstable conditions are produced, washed shell must be substituted for cement stabilized sand under the pipe.

3. In certain locations under railroad tracks, noted “encase pipe” in the storm sewer layout Drawings, the bedding shall be placed as shown in detail of Concrete Encased Pipe under Railroad Track in the Drawings. This bedding shall be formed and placed as described above for bedding in other areas except Class A concrete as described in Section 03 31 00.00 – Cast-in-Place Concrete shall be substituted for cement stabilized sand and the concrete bedding shall be provided above the midline of the pipe to a depth over top of pipe as shown on the Drawings. The concrete shall be rodded to remove voids and provide a monolithic encasement without horizontal seams. Pipe shall be blocked on brick or masonry blocks to correct grade and alignment, secure against either vertical or horizontal displacement during the placing of encasement.

4. Alignment of pipe will be checked and any misalignment shall be corrected as set out for sewer pipe, regardless of type of bedding.

D. Jointing Reinforced Concrete Sewer Pipe:

1. Reinforced concrete sewer and culvert pipe joints shall have neoprene gaskets. Neoprene gaskets shall conform to ASTM C 361 or ASTM C 443, with the provision that the Contractor shall furnish the Port Construction Representative with the Manufacturer’s Certificate of Analysis.

2. The ends of the pipe shall be accurately made and designed for use with the gaskets. The type joint and gasket shall be approved by the Port Construction Representative prior to shipment of pipe and joint materials from the manufacturer. The joint materials and workmanship shall provide a watertight joint.

E. Inspection of Joints and Field Test of Alignment: After joints have been inspected and approved by the Port Construction Representative, backfill shall be placed to depth of one foot or six inches above pipe in accordance with Section 31 23 35.00 - Excavation and Backfill for Utilities. A light will be flashed between manholes or manhole locations to check alignment. If alignment is found to be true with no pipes misplaced, line will be approved by the Port Construction Representative for continuation of backfill. Otherwise, misalignment shall be corrected, with specified bedding, before such approval will be granted.

F. Sewer Pipes through Bulkhead Walls of Wharves: Where sewer pipes pass through bulkhead walls of wharves, provide outfall structures under wharves as shown on the Drawings.

3.3 Reinforced Concrete Sewer Pipe Excavation, Trenching And Backfilling For Reinforced Concrete Drainage Sewers, Manholes, Inlets And Appurtenances

A. General:

1. Whatever substances encountered shall be excavated to the depth of sewers, manholes, inlets and other drainage structures shown on the Drawings. Excavated material shall be used for fill or backfill, as directed by the Port Construction Representative provided it meets the requirements of Section 31 23 23.13 - Backfill Materials or Section 31 23 35.00 - Excavation and Backfill for Utilities per location as described in Paragraph 3.3.E.1.

2. The Contractor shall furnish and place in positions as directed by the Port Construction Representative, all the necessary batter boards for locating the work. The grade boards shall be of such size timber as the Port Construction Representative shall designate.
Representative directs and be substantially supported. The batter boards shall be one inch by three inches, planed on all four sides to truly parallel faces. The boards and all location stakes must be protected from injury or change, and twilled lines for use in giving lines and grades, the necessary plummets and graduated poles shall be of a form approved by the Port Construction Representative.

3. Excavations for manholes, inlets and other accessories shall have 12-inch minimum and 24-inch maximum clearance on all sides.

4. Excess excavation below required level, except as otherwise specified, shall be backfilled with earth, sand, gravel or concrete as directed by the Port Construction Representative, and thoroughly tamped.

5. Unstable soil shall be removed and replaced with select material approved by the Port Construction Representative, thoroughly tamped into place. The depth of removal of unstable soil shall be as shown on the Drawings.

6. Ground adjacent to all excavations shall be graded to prevent water running into excavations and any water accumulated in the excavations will be removed by pumping or other means approved by the Port Construction Representative.

B. Trench Excavation:

1. Conform to requirements of Section 31 23 35.00 - Excavation and Backfill for Utilities.

2. See requirements for the construction of concrete pipe and concrete box sewers hereinafter under this Section for special excavation and backfilling provisions for reinforced concrete box sewers.

C. Dewatering Trench: No box sewer or pipe sewer shall be laid in a trench in the presence of water. All water shall be removed from trench sufficiently ahead of sewer placing operation to ensure a dry, firm bed on which to place the sewer, and trench will continue to be dewatered until after all concrete, mortar and joint material is set. Removal of water may be accomplished by bailing, pumping, or pumping in connection with well-point installation, as the particular situation may warrant. It is the Contractor's responsibility to identify locations where dewatering is warranted and to provide dewatering in accordance with Section 01 57 25.00 - Ground Water & Surf Water Control. Dewatering is to be provided at no additional cost to the Port Authority.

D. Bracing and Shoring: Where necessary, in the Port Construction Representative’s opinion, the sides of the trench shall be graced and rendered secure to the satisfaction of the Port Authority until the sewer has been laid and the trenches backfilled as hereinafter specified to a depth of at least 12 inches above the top of sewer. All bracing or sheet piling shall be provided at the Contractor’s expense and no extra compensation will be allowed therefore except such time that is ordered left in the trench by the Port Authority. The Contractor shall at all times remain responsible for bracing and shoring as well as worker safety. Bracing and shoring shall be in accordance with Section 31 41 33.00 - Trench Safety System.

E. Backfilling:

1. The following method of backfilling shall be used over and around precast pipe, manholes, inlets and other sewer appurtenances. Backfill material meeting the requirements of Section 31 23 23.13 - Backfill Materials, approved by the Port Construction Representative, shall be placed in six-inch (loose thickness) maximum layers and carefully compacted up to a minimum of one foot above the top of the sewer. For all storm sewer pipes from a point one foot above the top of sewer or leads to a point one and one-half foot below the surface of the ground backfill will be placed in accordance with Section 31 23 35.00 – Excavation and Backfill for Utilities.
2. After this operation has been completed to the satisfaction of the Port Construction Representative, the final one and one-half foot shall be placed and hand or machine compacted or rolled to secure compaction as directed by the Port Construction Representative. The Port Authority reserves the right to require the Contractor to use select material for the backfill at no extra compensation.

3. The following method of backfilling shall be employed where the sewers, manholes, inlets and other drainage appurtenances will be under shed or warehouse floors, pavements, paved roadways, or railroad tracks as indicated on the Drawings. Place backfill in accordance with Section 31 23 35.00 – Excavation and Backfill for Utilities. Material approved by the Port Construction Representative shall be placed around and over pipes or sewers in six-inch (loose thickness) maximum layers and carefully compacted up to a minimum of six inches above the top of pipe or sewer. Above this level over pipe and around structures, the earth backfill shall be compacted with power equipment by layers not to exceed six inches (compacted thickness). Pockets of silty and spongy material that may be found in the original undisturbed soil shall not be considered in making the comparison. Moisture shall be added or the soil allowed to dry out if necessary to achieve the required moisture content.

4. The backfill around manholes and inlets under pavements and railroads shall not be placed until the day after the structure is built and shall be power tamped from the bottom of the excavation to the subgrade, compacted the same as specified above for connecting sewers and leads in these areas.

5. The backfill as outlined above for pavement and railroad areas shall extend under all pavements and to a point five feet beyond the pavement and also under all existing and proposed railroad tracks shown on the Drawings to a point 12 feet from centerline of each track.

3.4 Corrugated Metal Pipe Sewer

A. The Contractor shall use great care in unloading and handling pipe. Pipe that is dented will be rejected.

B. The pipe shall be laid with the inside circumferential laps pointing downstream and with longitudinal laps at the sides. The pipe shall be set to flow lines and grades shown by the Drawings.

C. As band couplers are being tightened, the coupler shall be struck with a heavy hammer around the upper two-thirds circumference. The coupling shall be left until the coating of the pipe and the band coupler has set, and the bolts shall then be re-tightened.

D. The pipe shall be backfilled with six-inch maximum thickness (loose measurement) layers in accordance with compaction specification hereinabove.

E. Except as modified herein, the Contractor shall excavate, lay and backfill corrugated metal culverts in accordance with ASTM A 798, latest revision, for Installing Factory-Made Corrugated Steel Sewer Pipe.

3.5 Reinforced Concrete Box Sewer

A. General: Box sewers under wharves, pavements, roadways and railroad areas shall be constructed to the location, line and grade and in accordance with details shown on the Drawings.

B. Construction:
   1. Excavation and Backfill:
      a. Excavation and backfill shall be as specified hereinbefore for reinforced concrete pipe and monolithic sewers except as modified herein.
      b. Trenching for box sewer may be open cut with sides on steepest slope that is safe and practicable to minimize the extent of backfill work, provided that adjoining railroads, roads, buildings and other
improvements shall not be endangered or damaged by such excavation. The Contractor may be required by the Port Authority to install sheeting and bracing if, in the opinion of the Port Construction Representative, the excavation is otherwise unsafe; nevertheless, the Contractor shall be responsible for worker safety and damage to adjoining improvements whether or not sheeting and bracing are used.

c. The bottom of trench shall be fine graded to elevations required for base, and overdepth excavation may be filled with concrete or backfilled with selected soil approved by the Port Construction Representative and compacted to the density of the adjoining natural ground (except soft and spongy spots in such comparison).

d. Following the completion of backfill placement up to one foot over top of sewer for full length thereof, the Contractor may divert drainage flow through the sewer.

e. The Contractor shall backfill on both sides and over the top of box sewer with selected material approved by the Port Construction Representative out of material excavated for such sewer. The backfill shall be placed from bottom of excavation to top of subgrade or finish grade above, in layers not exceeding six inches (compacted thickness), and mechanically tamped in accordance with requirements hereinbefore prescribed for backfill of drainage sewers and structures under this Section 31 23 35.00 Excavation and Backfill for Utilities.

2. Concrete Construction: Forms, reinforcing steel and concrete shall be placed and completed as specified in Section 03 30 00.00 – Cast-in-Place Concrete.

3.6 Manholes

A. Manholes shall be constructed at locations shown on the Drawings, of the type and depth indicated, in accordance with details shown on the Drawings and these Specifications.

B. Walls for structures within paved area are to be constructed of Class C concrete. Walls for structures outside of proposed or future paved areas may be constructed of Class C concrete or brick. Where brick is used in the construction of manholes, every fifth course of brick shall be laid in such a manner as to effect a tie between such course and the courses immediately there under. In general, the long axis of the tie course will be perpendicular to the long axis of the preceding four courses. Thoroughly wet brick before laying.

C. On pipe sewers, the concrete foundation for manholes shall be placed as soon as practicable after the sewer is complete through the manhole location. Unless otherwise directed, bases for manholes or monolithic concrete sewers shall be placed at the same time the sewer is being construction. Steps shall be placed in walls as shown by Drawings. One-half inch mortar joints shall be used in brick work, struck flush on inside of manhole. The outside of brick manholes shall be plastered with one-half inch mortar cover carried up with the brick work.

D. All mortar shall consist of one part Portland cement and three parts clean, durable, sharp sand meeting the specifications for concrete material.

E. Where inlet leads, main or lateral pipe sewers enter manholes, pipes shall be cut off flush with inside of manhole and any irregularities shall be pointed up with mortar.

F. Set the cast iron manhole cover frame in a full mortar bed and adjusted to the elevations on the Drawings. The inverts of the sewer lines entering the manhole at or near the flow line elevation of the manhole shall be shaped and grouted across the floor of the manhole using mortar to obtain the proper contour.

3.7 Inlets And Drainage Junction Boxes

CSP Date: April 1, 2014  33 40 00.00 Add  STORM DRAINAGE UTILITIES  Page - 11
A. All inlets and junction boxes shall be constructed to line and grade at the locations shown on the Drawings in accordance with details shown in the Drawings and these Specifications. The walls of cast in place inlets may be constructed of Class E concrete or of brick. Cast in place junction boxes shall be Class E concrete. The floor slab and beam for inlets shall be Class E concrete. All inlet and junction box leads shall be neatly cut off at the inside face of inlet or box wall and pointed up with mortar. Forms will be required for both the outside and inside faces of concrete inlet or box walls except when the nature of the material excavated is such that it can be hand trimmed to a smooth vertical face, the outside forms may be omitted if approved by the Port Construction Representative.

B. Shape floor of inlets and boxes by filling with mortar to provide channels between ends of pipes.

C. Cast iron inlet plate frames shall be accurately adjusted to line, grade, and slope, and grouted in place with mortar.

D. Mortar used for construction of inlets shall be as specified for manholes.

E. All mortar shall consist of one part Portland cement and three parts clean, durable, sharp sand meeting the specifications for concrete material.

3.8 Miscellaneous And Special Concrete Drainage Structures

All miscellaneous and special reinforced concrete drainage structures shall be constructed of materials indicated on the Drawings and specified hereinbefore for sewers, manholes, and inlets, to location, line and grades and in accordance with details shown on the Drawings. Excavation and backfill methods shall be in accordance with applicable specifications provided hereinbefore for concrete sewers, inlets and manholes.

END OF SECTION
PORT OF HOUSTON AUTHORITY  
TECHNICAL SPECIFICATIONS FOR  
CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL  
SECTION 33 42 13.13 Add - CORRUGATED METAL PIPE

PART 1 GENERAL

1.1 SECTION INCLUDES
Subject to the General and Special Conditions, this section includes:
2. Corrugated metal pipe with smooth interior (CMPSI).

1.2 RELATED SECTIONS
A. 31 23 35.00 - Excavation and Backfill for Utilities
The requirements of Division 01 and general and special conditions of this contract apply to this work.

1.3 REFERENCES
A. AASHTO M 190 - Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
B. AASHTO M 196 - Corrugated Aluminum Pipe for Sewers and Drains.
C. AASHTO M 197 - Aluminum Alloy Sheet for Corrugated Aluminum Pipe.
D. AASHTO M 232 - Zinc Coating (Hot Dip) on Iron and Steel Hardware

1.4 MEASUREMENT AND PAYMENT
A. Subject to Section III, metal pipe shall be measured and paid for in accordance with Measurement and Payment described in 33 40 00.00 installed, completed in accordance with these specifications and the applicable portions of 33 40 00.00, and accepted by the Port Construction Representative.

1.5 SUBMITTALS
A. Contractor shall provide submittals in conformance with requirements of the General and Special Conditions.
B. Submit shop drawings with the following information:
   1. Design dimensions and details for pipe and fittings indicating alignment, grade, and laying dimensions.
   2. Fabrication details, details of fittings and flanges, details of specials, and proposed welding procedures.
   3. Show location for pipe and fittings corresponding to Drawings.
   4. Provide manufacturer’s documentation for manning’s coefficient of corrugated metal pipe with smooth interior.

1.6 QUALITY ASSURANCE
Provide manufacturer’s affidavits that pipe was manufactured in compliance with standards referenced in this Section, and that coatings and linings were not applied or allowed to cure in freezing temperatures.
PART 2 PRODUCTS

2.1 Pipe And Fittings

A. Corrugated metal pipe is to be aluminum as indicated on Drawings and conforming to AASHTO M 197.
   1. Reference to gauge of metal is to U.S. Standard Gauge for uncoated sheets. The tables in AASHTO M 197 list thicknesses in inches for clad aluminum sheets.

B. Coupling bands and other hardware for galvanized or aluminized steel pipe shall conform to requirements of AASHTO M 196 for aluminum pipe.
   1. Coupling bands shall be not more than 3 nominal sheet thicknesses lighter than thickness of pipe to be connected and in no case lighter than 0.052 inch for steel or 0.048 inch for aluminum.
   2. Coupling bands shall be made of same base metal and coating (metallic or otherwise) as pipe.
   3. Minimum width of corrugated locking bands shall be as shown below for corrugations which correspond to end circumferential corrugations on pipes being joined:
      a. 10-1/2 inches wide for 2-2/3-inch x 1/2-inch corrugations.
      b. 12 inches wide for 3-inch x 1-inch corrugations.
   4. Helical pipe without circumferential end corrugations will be permitted only when it is necessary to join a new pipe to an existing pipe, which was installed with no circumferential end corrugations. In this event pipe furnished with helical corrugations at ends shall be field jointed with either helically corrugated bands or with bands with projections (dimples). The minimum width of helical corrugated bands shall conform to the following:
      a. 12 inches wide for 1/2-inch-deep helical end corrugations.
      b. 14 inches wide for one-inch-deep helical end corrugations.
   5. Bands with projections shall have circumferential rows of projections with one projection for each corrugation. Width of bands with projections shall be not less than the following:
      a. 12 inches wide for pipe diameters up to and including 72 inches. Bands shall have two circumferential rows of projections.
   6. Bolts for coupling bands shall be 1/2-inch diameter. Bands 12 inches wide or less will have a minimum of 2 bolts per end at each connection, and bands greater than 12 inches wide shall have a minimum of 3 bolts at each connection.
   7. Galvanized bolts may be hot dip galvanized in accordance with requirements of AASHTO M 232, mechanically galvanized to provide same requirements as AASHTO M 232, or electro-galvanized per ASTM B 633, Type RS.

C. Furnish all fittings and specials required for bends, end sections, branches, access manholes, and connections to other fittings. Design fittings and specials in accordance with Drawings and ASTM A 760. Fittings and specials are subject to same internal and external loads as straight pipe.

D. CMPSI Pipe shall need the following requirements:
   1. Pipe shall have a coefficient of 0.012 and a HS 20 live load.

2.2 Pipe Fabrication

A. Aluminum Pipe:
   1. Pipe shall conform to the requirements of AASHTO M 196, Type I, Type IA, circular pipe, or Type II, pipe arch as indicated on the Drawings.
   2. Fabrication with circumferential corrugations, lap joint construction with riveted or spot-welded seams, or helical corrugations with a continuous helical lock seam.
3. Portions of aluminum pipe that will be in contact with concrete or metal other than aluminum, shall be insulated from these materials with a coating of bituminous material meeting requirements of AASHTO M 190. Extend coating a minimum distance of one foot beyond area of contact.

PART 3 EXECUTION

3.1 Preparation

A. Damaged spelter coating shall be repaired by thoroughly wire brushing damaged area and removing all loose, cracked, or weld-burned spelter coating. Cleaned area shall be painted with a zinc dust-zinc oxide paint conforming to Federal Specifications TT-P-641G(1).

B. Damaged aluminized or polymer coating shall be repaired in accordance with manufacturer's recommendations.

3.2 Earthwork

A. Excavate in accordance with requirements of Section 31 23 35.00 - Excavation and Backfill for Utilities. When pipes are laid in a trench, the trench when completed and shaped to receive the pipe, shall be of sufficient width to provide free working space for satisfactory bedding and jointing and thorough compaction of backfill and bedding material under and around pipe.

B. Bed pipe as shown on Plans. When requested by the Port Construction Representative, furnish a simple template for each size and shape of pipe for use in checking shaping of bedding. Template shall consist of a thin plate or board cut to match lower half of cross section.

C. Where rock in either ledge or boulder form exists below pipe, remove the rock below grade and replace with suitable materials so that a slightly yielding compacted earth cushion is provided below pipe a minimum of 12 inches thick.

D. Where soil encountered at established grade is quicksand, muck or similar unstable materials, such unstable soil shall be removed and replaced in accordance with requirements of Section 31 23 35.00 - Excavation and Backfill for Utilities. Do not allow cement stabilized materials for backfill to come into contact with any uncoated aluminum or aluminized pipe surface.

E. After metal pipe structure has been completely assembled on proper line and grade and headwalls constructed when required by the drawing details, place selected material from excavation or borrow along both sides of the completed structures equally, in uniform layers not exceeding 6 inches in depth (loose measurement), wetted if required and thoroughly compacted between adjacent structures and between structure and sides of trench, or for a distance each side of structure equal to diameter of pipe. Backfill material shall be compacted to the same density requirements as specified for adjoining sections of embankment in accordance with specifications. Above three-fourths point of structure, place uniformly on each side of pipe in layers not to exceed 9 inches.

F. Only hand operated tamping equipment will be allowed within vertical planes 2 feet beyond horizontal projection of outside surface of structure for backfilling, until a minimum cover of 12 inches is obtained. Remove and replace damaged pipe.

G. Do not permit heavy earth moving equipment to haul over structure until a minimum of 4 feet of permanent or temporary compacted fill has been placed.

H. During backfilling, obtain uniform backfill material and uniform compacted density throughout length of structure so that unequal pressure will be avoided. Provide proper backfill under structure.
I. Prior to adding each new layer of loose backfill material, an inspection will be made of inside periphery of structure for local or unequal deformation caused by improper construction methods. Evidence of deformation will be reason for such corrective measures as may be directed by the Port Construction Representative.

3.3 Piping Installation

A. Place pipes on prepared foundation starting at outlet end. Join sections firmly together, with side laps or circumferential joints pointing upstream and with longitudinal laps on sides.

B. Metal in joints which is not protected by galvanizing or aluminizing shall be coated with an approved asphaltum paint.

C. Provide proper equipment for hoisting and lowering sections of pipe into trench without damaging pipe or disturbing prepared foundation and sides of trench. Pipe, which is not in alignment or which shows undue settlement after laying, or is damaged, shall be taken up and relaid.

D. Where extensions are attached to existing structures, install a proper connection between structure and existing as indicated on Drawings, coat the connection with bituminous material when required.

3.4 Jointing

A. Field joints shall maintain pipe alignment during construction and prevent infiltration of side material.

B. Coupling bands shall lap equally on pipes being connected to form a tightly-closed joint.

C. Use corrugated locking bands to field join pipes furnished with circumferential corrugations including pipe with helical corrugations having reformed circumferential corrugations on ends. Fit locking bands into a minimum of one full circumferential corrugation of pipe ends being coupled.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
Subject to the General and Special Conditions, this Section includes reinforced concrete pipe for sanitary sewers and storm sewers.

1.2 RELATED SECTIONS
A. 02400 - Jacking, Boring, or Tunneling Pipe
B. 33 30 00.00 – General Sanitary Sewers
C. 33 40 00.00 - Storm Drainage Utilities
The requirements of Division 01 and general and special conditions of this contract apply to this work.

1.3 REFERENCES
A. ASTM C 76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
B. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe.
C. ASTM C 497 - Method of Testing Concrete Pipe, Sections, or Tile.
D. ASTM C 506 - Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe
E. ASTM C 507 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.
F. ASTM C 655 - Reinforced Concrete D-load Culvert, Storm Drain and Sewer Pipe.
G. ASTM C 822 - Standard Definitions and Terms Relating to Concrete Pipe and Related Products.

1.4 MEASUREMENT AND PAYMENT
A. All concrete pipe sewers, and reinforced concrete box sewers constructed in accordance with the above specifications and accepted by the Port Construction Representative shall be measured and paid by the linear foot of the size installed, completed and accepted; in accordance with Section 33 40 00.00.

1.5 SUBMITTALS
A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Submit complete product data for pipe, fittings and gaskets for approval. Indicate conformance to appropriate reference standards.
C. Submit certificates by a testing laboratory, hired and paid by the manufacturer, that concrete pipes meet applicable standards when tested in accordance with ASTM C 497.
D. For jacking pipe, submit drawings and data describing grouting port design and closure procedures when required by Section 02400 - Jacking, Boring, or Tunneling Pipe, including liner repair, as applicable.

PART 2 PRODUCTS

2.1 Reinforced Concrete Pipe

A. Circular reinforced concrete pipe shall conform to requirements of ASTM C 76, for Class III wall thickness. Joints shall be rubber gasketed conforming to ASTM C 443.

B. Reinforced concrete arch pipe shall conform to the requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.

C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to the requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Joints shall be rubber gaskets conforming to ASTM C 877.

D. Reinforced concrete D-load pipe shall conform to the requirements of ASTM C 655.

E. Reinforced concrete pipe shall be marked with pipe class, date of manufacture, manufacturer’s name, and location of elliptical reinforcement, as required by the above specifications.

2.2 Gaskets

A. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM C 877 for reinforced concrete elliptical pipe.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket materials for the noted contaminants:

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other Contaminants</td>
<td>As recommended by the pipe manufacturer</td>
</tr>
</tbody>
</table>

2.3 Source Quality Control

Port Construction Representative will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3 EXECUTION

3.1 Installation

A. Conform to requirements of the following Sections, as applicable:

1. Section 33 30 00.00 – General Sanitary Sewers.
2. Section 33 40 00.00 - Storm Drainage Utilities.

B. Install reinforced concrete pipe in accordance with manufacturer’s recommendations.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 42 70.00 Add - PLASTIC LINER FOR LARGE DIAMETER CONCRETE SEWERS AND STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this Section includes installation of plastic liners for concrete interceptor sewers and structures. Only plastic liners manufactured with integral locking ribs spaced at approximately 2-1/2 inches on center over the entire liner is acceptable. Liners relying on mechanically fastened batten strips as the primary means of anchorage are unacceptable.

1.2 RELATED SECTIONS

The requirements of Division 01 and general and special conditions of this contract apply to this work.

1.3 REFERENCE STANDARDS


1.4 MEASUREMENT AND PAYMENT

A. No separate payment will be made for Work performed under this Section. The cost shall be incidental to the work of large diameter sewers and precast or cast-in-place wastewater-containing structures including manholes and lift station.

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.
B. Submit shop drawings in conformance with the requirements of the General and Special Conditions.
C. Prior to submittal of shop drawings, the manufacturer shall approve the proposed panel layout and proposed details. The Contractor shall then submit shop drawings showing the proposed panel layout to cover the area to be lined. Shop drawings shall also show the proposed details for installation of liner at seams, terminations, corners, openings, pipe penetrations, etc., and the type of factory and field welds and attachments.
D. Provide sufficient details to permit placement of liner without use of design Drawings. Reproduction of design Drawings for use as shop drawings will not be allowed. Do not begin fabrication of the liner until after shop drawings and submitted materials have been reviewed and accepted by the Engineer.

1.6 INSTALLER QUALIFICATIONS

A. Applicators: The application of plastic liner to forms and other surfaces, liner finishing, repair, and testing is considered highly specialized work and shall be performed only by firms and individuals recommended and approved by the lining manufacturer. Personnel
performed such work shall be trained in methods of installation and shall demonstrate their ability to the Port Construction Representative.

B. Welders:

1. Each welder shall pass a qualification welding test before doing any welding. Requalification may be required at any time deemed necessary by the Port Construction Representative. Provide at least 24 hours notice to the Port Construction Representative to schedule a qualification welding test.

2. All test welds shall be made in the presence of the Port Construction Representative and shall consist of the following:
   a. Begin with two pieces of liner, at least 15 inches long and 9 inches wide. Hold pieces in a vertical position, lapped 1-1/2 inches.
   b. Position a weld strip over the edge of the lap and weld to both pieces of liner. Extend each end of the weld strip at least 2 inches beyond the liner to provide tabs.

3. The weld specimen will be tested as follows:
   a. Each weld strip tab, tested separately, shall be subjected to 10-pound pull normal to the face of the liner with the liner secured firmly in place. The weld is acceptable if there is no separation between the weld strip and liner.
   b. Three test specimens shall be cut from the welded sample and tested in tension across the welds. Tensile strength measured across welded joints shall be at least 2000 psi when tested in accordance with ASTM D412. If none of these specimens fails when tested as indicated above, the weld will be considered satisfactory.
   c. If one specimen fails to pass the tension test, a retest will be permitted. The retest shall consist of testing three additional specimens cut from the original welded sample. If the three retest specimens pass the test, the weld will be considered satisfactory.

4. A disqualified welder may submit a new weld sample when the welder has had sufficient off-the-job training or experience to warrant re-examination.

PART 2 PRODUCTS

2.1 Manufacturers

Plastic liner shall be as manufactured by Ameron Protective Linings Division; Poly-Tee, Inc.; or approved substitution.

2.2 Materials

A. Manufacturing:

1. Plastic liner sheet, joint, corner and weld strips shall be manufactured from a high molecular weight thermoplastic polymer compounded to make a permanently flexible material suitable for use as protective liner in concrete pipe or other concrete structures. Polyvinyl chloride resin shall constitute not less than 99 percent by weight of the resin used in the formulation. Copolymer resins shall not be permitted.

2. At any time during the manufacture or prior to the final acceptance of the Work, the Port Construction Representative may sample specimens taken from sheets, strips, or welded joints for testing.

3. Changes in formulation will be permitted only after prior notice is given to the Port Construction Representative and the manufacturer demonstrates that the new plastic liner will meet or exceed requirements for chemical resistance and physical properties.
B. Properties:

1. Plastic liner sheets including locking extensions, joints, corners, and welding strips shall be free of cracks, cleavages or other defects adversely affecting the protective characteristics of the material.

2. Except at shop welds, plastic liner sheets, joint, corner, and weld strips shall have the following properties when tested at 77 degrees F plus or minus 5 degrees F.

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>ASTM TEST METHOD</th>
<th>CHEMICAL RESISTANCE TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength, min.</td>
<td>D 412, Die B</td>
<td>Initial: 2200 psi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After chemical exposure: 2100 psi</td>
</tr>
<tr>
<td>Elongation at break, min.</td>
<td>D 412, Die B</td>
<td>200 percent</td>
</tr>
<tr>
<td>Shore durometer, Type D</td>
<td>D 2240, Within 1 sec.</td>
<td>50-60</td>
</tr>
<tr>
<td></td>
<td>D 2240, 10 sec.</td>
<td>35-50</td>
</tr>
<tr>
<td>Weight change</td>
<td>(Note 3)</td>
<td>—</td>
</tr>
</tbody>
</table>

Notes:

1. For 112 days in chemical solutions
2. With respect to initial test results
3. Specimen shall be 1 inch x 3 inch sample sheet thickness, taken from sheet or strip at any time prior to final acceptance of the work.

2.3 Material Tests

A. Material Properties: Samples taken from sheets, joints or weld strips shall be tested to determine material properties. Determination of PVC tensile strength and elongation shall be in accordance with ASTM D 412 using Die B. Determination of indentation hardness shall be in accordance with ASTM D 2240 using a Type D durometer, except that a single thickness of material will be used. Determination of change of weight and indentation hardness shall be made of 1-inch by 3-inch specimens. Thickness of specimens shall be the thickness of the sheet or strip.

B. Measurement of Initial Physical Properties: Determine the initial values for tensile strength, weight, elongation and indentation hardness prior to chemical resistance tests.

C. Chemical Resistance Tests:

1. Determine the physical properties of the specimens after exposure to chemical solutions. Test specimens shall be conditioned to constant weight at 110 degrees F before and after submersion in the following solutions for a period of 112 days at 77 degrees F plus or minus 5 degrees F.

<table>
<thead>
<tr>
<th>Chemical Solution</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid</td>
<td>20%*</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>5%</td>
</tr>
</tbody>
</table>
Ammonium hydroxide 5%*
Nitric acid 1%*
Ferric chloride 1%
Soap 0.1%
Detergent (linear alkyl benzyl sulfonate or LAS) 0.1%
Bacteriological BOD not less than 700 ppm
* Volumetric percentages of concentrated C.P. grade reagents.

2. At 28-day intervals, remove specimens from each chemical solution and test. If any specimen fails to meet the 112-day property requirements specified in paragraph 2.2B before completion of the 112-day exposure, the material will be rejected.

D. Pull Test for Locking Extensions: Liner locking extensions embedded in concrete shall withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for a period of 1 minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at a temperature between 70 degrees F and 80 degrees F, inclusive.

E. Shop-Welded Joints: Shop-welded joints used to fuse individual sections of liner together, shall meet the minimum requirements of the liner for thickness, corrosion resistance and impermeability. Welds shall show no cracks or separations and shall be tested for tensile strength. Tensile strength, measured across the welded joint in accordance with ASTM D 412 using Die B, shall be at least 2000 psi. Test temperature shall be 77 degrees F plus or minus 5 degrees F and the measured minimum width and thickness of the reduced test specimen section shall be used.

F. Spark Test: Liners shall be shop and field tested for holidays or flaws using an approved spark tester set to provide a minimum of 20,000 volts (Tinker and Rasor Model AP-W with power pack, or approved equal). Sheets having holes shall be satisfactorily repaired in the shop prior to shipment from the manufacturer's plant. Repairs shall be made by welders qualified in accordance with these specifications.

2.4 Material Details And Dimensions

A. Approval of Details: Liner sheet, strip, and other accessory pieces shall conform to the requirements of these Specifications.

B. Thickness of Material: The minimum thickness of PVC sheet and strip shall be as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness in Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet, integral locking extensions</td>
<td>0.065</td>
</tr>
<tr>
<td>Sheet, plain</td>
<td>0.094</td>
</tr>
<tr>
<td>Joint strip</td>
<td>0.094</td>
</tr>
<tr>
<td>Weld strip</td>
<td>0.125</td>
</tr>
</tbody>
</table>

C. Material Sizes: Sheets of PVC liner used for pipe shall be pipe-size sheets to provide the coverage required by the Drawings. Structural sheets shall be standard 48-inches by 96-inches, with any special size noted on the shop drawings. Lengths specified shall include tolerance at a ratio of plus or minus 1/4-inch for each 100 inches, or 0.25 percent. Joint strips shall be 4 inches plus or minus 0.25 inch in width and shall have each edge beveled prior to application. Weld strips shall be 1 inch plus or minus 0.125 inch in width. Weld strips shall have edges beveled at time of manufacture.

D. Locking Extensions:

1. No polygrip-type holding or locking extension will be permitted.
2. PVC liner to be embedded in concrete shall have integral locking extensions. Liner may not be bonded to concrete surfaces with adhesives except as specifically acceptable to the Port Construction Representative.

3. PVC locking extensions shall be the same material as the liner, shall be integrally molded or extruded with the sheets, and shall have an approved cross section with a minimum height of 0.375 inch and a minimum web thickness of 0.085 inch. They shall be approximately 2.5 inches apart and shall be such that when the extensions are embedded in concrete, the liner will be held permanently in place.

4. PVC locking extensions shall be parallel and continuous except where interrupted for joint flaps, weep channels, strap channels and for other purposes shown on Drawings or permitted by the Port Construction Representative.

5. The liner sheet edge which will be the lower terminal edge in the structure shall not extend beyond the base of the final locking extension more than 0.375 inch.

E. Provisions for Strap Channels: Unless alternate methods are acceptable to the Port Construction Representative, the liner required to be secured to the inner form with straps shall have strap channels at not more than 20 inches on center perpendicular to the locking extensions. Strap channels shall be a maximum of 1-inch wide and formed by removing the locking extensions so that a maximum of 3/16-inch remains. The channels shall not be provided in the final two locking extensions adjacent to the terminal edge of the liner coverage.

F. Flaps: When transverse flaps are specified or required, they shall be fabricated by removing locking extensions so that no more than 1/32 inch of the base of the locking extensions remains on the sheet.

G. Adhesive Products: Adhesive products and application procedures used in the installation of the liner shall be according to the manufacturer's recommendations. Adhesive products intended for use inside cast-in-place structures shall be non-flammable.

H. Cleaners: Cleaners used in the installation of the liner shall be reviewed by the Port Construction Representative prior to use. Cleaners shall be nonflammable and shall be water soluble or water dispersible and shall not be detrimental to the plastic liner.

I. Caulking Products: Caulking products and application procedures used in the installation of liner and appurtenances shall be as recommended by the manufacturer.

J. Mechanical Anchors: When approved for use with plain sheet liner, provide anchors and washers of Type 316 stainless steel, and as recommended by the liner manufacturer.

**PART 3 EXECUTION**

3.1 Notification

Notify the Port Construction Representative at least 24 hours before reinforcing steel placement so that the lining may be inspected and errors corrected without delaying the Work.

3.2 Placing Liner

A. Location: Liner shall be placed throughout the entire length of the interceptor sewer along the top 300 degrees of the pipe circumference, and inside all structures as indicated on the Drawings. Liner shall be applied and secured to the forms and inspected by the Port Construction Representative prior to the placement of reinforcing steel.
B. Coverage:

1. In cast-in-place structures, no offset of the lower terminal edge is permitted. Unless otherwise shown on the Drawings, the lower terminal edge shall be one foot below the low water level ("all pumps off" level for lift stations), or 6 inches below the top of the grout or concrete fillet, whichever is higher.

2. At any station where there is a difference in the pipe's circumferential liner coverage, as shown on the Drawings, and the longitudinal terminal edges of liner downstream from that station are lower than those upstream, the terminal edges of the liner installed in the section of pipe or structure immediately upstream from the station shall be sloped uniformly for the entire length of the section of pipe or structure from the limits of the smaller coverage to those of the greater coverage. Wherever the longitudinal terminal edges of the liner downstream from the station are higher than those upstream, the slope shall be accomplished uniformly throughout the length of the section of pipe or structure immediately downstream from the station. An approved locking extension shall be provided along all sloping lower terminal edges of liner plate.

C. Positioning Liner:

1. Position PVC liner installed in pipe so that locking extensions are parallel to the longitudinal axis of the pipe.

2. Position PVC liner installed in cast-in-place structures so that the locking extensions are parallel to the direction of concrete placement, which is normally vertically for vertical walls.

3. Liner shall be closely fitted to inner forms. Sheets shall be cut to fit curved and warped surfaces using a minimum number of separate pieces.

4. The Port Construction Representative may require the use of patterns or the marking of sheet layouts directly on the forms where complicated warped surfaces are involved.

5. At transverse joints between sheets of liner used in cast-in-place structures and pipe joints, the space between ends of locking extensions, measured longitudinally, shall not exceed 4 inches. Where sheets are cut and joined for the purpose of fitting irregular surfaces, this space shall not exceed 2 inches.

D. Securing Liner in Place:

1. Liner shall be held snugly in place against inner forms. For pipes and similar circular sections, light steel banding straps or other approved means shall be used. Prefabricated pipe-size tubular sheets which do not require strap channels may also be used.

2. Banding straps, when used, shall be placed in strap channels, as specified under provision for strap channels, at a spacing not to exceed 20 inches.

3. Any method of banding, other than in strap channels, shall be reviewed by the Port Construction Representative prior to use.

4. On vertical surfaces where form ties or form stabilizing rods pass through liner, provisions shall be made to maintain the liner in close contact with the forms during concrete placement. These provisions shall be reviewed by the Port Construction Representative.

5. Concrete shall be prevented from flowing around the edges of sheets at joints by sealing the joint or seam with waterproof tape recommended by the manufacturer.

6. Forms in contact with plastic liner need not be oiled.
E. Weep Channels:

1. At each pipe joint and at transverse joints in cast-in-place structures, a gap not less than 2 inches nor greater than 4 inches shall be left in all locking extensions to provide a transverse weep channel. If locking extensions are removed to provide a weep channel at joints, the base of the extension left on the sheet shall not exceed 3/16 inch.

2. Intermediate weep channels shall be provided as required to maintain a maximum spacing of 8 feet. Intermediate weep channels shall not be less than 2.0 inches nor greater than 4.0 inches in width. If locking extensions are removed to provide intermediate weep channels, the base of the extension left on the sheet shall not exceed 3/16 inch.

3. Any area behind liner, which is not properly served by regular weep channels, shall have additional weep channels 2 inches wide provided by cutting away locking extensions.

4. A transverse weep channel shall be provided approximately 12 inches away from each liner return where surfaces lined with plastic liner join surfaces which are not so lined.

5. As a part of the work of installing liner, outlets of all weep channels shall be cleared of obstructions which would interfere with their proper functions.

6. Weep channels shall be designed for external hydrostatic pressures of a water column equal in height to the greater of 50 feet (22 psi) or 1.1 times the depth of burial.

F. Liner Returns:

1. A liner return shall be installed where shown on the approved shop drawings and wherever surfaces lined with plastic liner joins surfaces which are not so lined.

2. Unless otherwise indicated by the Drawings or the approved shop drawings showing liner installation methods, returns shall be made as follows:
   a. The liner shall be returned at least 3 inches at the surfaces of contact between the concrete structure and items not concrete (including access frames, gate guides and pipe penetrations).
   b. The same procedure shall be followed at joints where the type of protective lining is changed, or the new work is built to join existing unlined concrete.

3. Locking extensions shall be provided on returns to lock the returns to the concrete of plastic-lined, cast-in-place structures.

4. Each liner return shall be sealed to adjacent construction with which it is in contact by means of an adhesive system recommended by the manufacturer and acceptable to the Port Construction Representative. If the joint space is too wide or the joint surfaces too rough to permit the use of the compound, the joint space shall be filled with 2 inches of densely caulked cement mortar, lead wool, or other caulking material and finished with a minimum of 1 inch depth of an approved corrosion resistant sealant material.

3.3 Concreting Operations

A. Concrete Placement:

1. Concrete placed against liner shall be carefully vibrated so as to avoid damage to the liner and to produce dense concrete securely anchoring the locking extensions into the concrete. External vibrators shall be used in addition to internal vibrators, particularly along the lower terminal edge of the liner.

2. Stiffeners, when used along locking extensions of liner installed in forms for pipe, shall be withdrawn completely during the placement of concrete in the forms. The concrete shall be revibrated to consolidate the concrete in the void spaces caused by the withdrawal of the stiffeners.
B. Removing Forms:

1. In removing forms, care shall be taken to protect liner from damage. Sharp instruments shall not be used to pry forms from lined surfaces. When forms are removed, any nails that remain in the liner plate shall be pulled without tearing the liner and the resulting holes clearly marked. Form tie holes shall be marked before ties are broken off and all areas of abrasion of the liner shall be marked.

2. Following completion of form removal, liner in pipe and structures shall be cleaned for inspection.

3. Banding straps used in securing liner to forms for pipe and cast-in-place structures shall be removed within the limits of the unlined invert.

3.4 Field Jointing Of Liner

A. Installation Requirements:

1. No field joint shall be made in the liner until the lined pipe or structure has been backfilled and 7 days have elapsed after the flooding or jetting has been completed. Where ground water is encountered, the joint shall not be made until pumping of ground water has been discontinued for at least 7 days and no visible leakage is evident at the joint. Liner at joints shall be free of all mortar and other foreign material and shall be clean and dry before joints are made.

2. Hot joint compound shall not be brought in contact with liner.

3. No coating of any kind shall be applied over any joint, corner or welding strip, except where nonskid coating is applied to liner surfaces.

B. Field Joints in Pipe Installation:

1. Field joints in the lining at pipe joints shall be one of the following types:
   a. Type P-1: The joint shall be made with a separate 4-inch joint strip and two welding strips. The 4-inch joint strip shall be centered over the joint, heat-sealed to the lining, then welded along each edge to adjacent liner sheets with a 1-inch weld strip. The 4-inch joint strip shall lap over each sheet a minimum of 1/2 inch.
   b. Type P-2:
      1) The joint shall be made with a joint flap with locking extensions removed as described in paragraph 2.04 above, and extending approximately 4 inches beyond the pipe end. The joint flap shall overlap the lining in the adjacent pipe section a minimum of 1/2 inch and be heat-sealed in place prior to welding. The field joint shall be completed by welding the flap to the lining of the adjacent pipe using 1-inch weld strip.
      2) Care shall be taken to protect the flap from damage. Excessive tension and distortion in bending back the flap to expose the pipe joint during laying and joint mortaring shall be avoided. At temperatures below 50 degrees F heating of the liner may be required to avoid damage.

2. Field joints in liner at pipe joints shall not be made until the mortar in the pipe joint, if used, has been allowed to cure for at least 48 hours.

3. Joints between lined pipe and lined structures shall be either Type C-1 joint or Type C-2 joint as described below.
C. Field Joints in Concrete Structures: Field joints in liner on concrete structures shall be one of the following types:

1. **Type C-1:** The joint shall be made with a separate 4-inch joint strip and two welding strips. The 4-inch joint strip shall be centered over the joint, heat-sealed to the liner, then welded along each edge to adjacent sheets with a 1-inch wide weld strip. The width of the space between adjacent sheets shall not exceed 2 inches. The 4-inch joint strip shall lap over each sheet a minimum of 1/2 inch. It may be used at any transverse or longitudinal joint.

2. **Type C-2:** The joint shall be made by lapping sheets not less than 1/2 inch. One 1-inch weld strip is required. The upstream sheet shall overlap the one downstream. The lap shall be heat-sealed into place prior to welding on the 1-inch weld strip.

3. **Type C-3:** The joint shall be made by applying 2-inch wide waterproof tape or 1-inch wide welding strip on the back of the maximum 1/4-inch gap butt joint or by some other method approved by the Port Construction Representative to prevent wet concrete from getting under the sheet. After the forms have been stripped, a 1-inch weld strip shall be applied over the face to the sheet.

D. Installation of Welding Strips:

1. All welding of joints is to be in strict conformance with the specifications and instructions of the lining manufacturer.

2. Welding shall fuse both sheets and weld strip together to provide a continuous joint equal in corrosion resistance and impermeability to the liner plate.

3. Hot-air welding tools shall provide effluent air to the sheets to be joined at a temperature between 500 degrees F and 600 degrees F. Welding tools shall be held approximately 1/2 inch from and moved back and forth over the junction of the two materials to be joined. The welding tool shall be moved slowly enough as the weld progresses to cause a small bead of molten material to be visible along both edges and in front of the weld strip.

4. Adequate ventilation shall be maintained in confined spaces during welding operations.

5. After repairs have been made, defective welds will be reinspected and re-tested.

E. Joint Reinforcement: A 12-inch long welding strip shall be applied as reinforcement across each transverse joint and weep channel which extends to the lower terminal edge of liner. These reinforcement strips shall be centered over the joint being reinforced and located as close to the lower edge of liner as practicable. They shall be welded in place after the transverse welding strips have been installed.

F. Application of Liner to Concrete Surfaces with Adhesives: Application of liner plate to concrete surfaces by means of adhesive shall be allowed only where shown on the Drawings for existing structures, or where specifically acceptable to the Port Construction Representative and called out on approved shop drawings, and shall be accomplished by the following steps:

1. The concrete surface shall be etched by abrasive blasting to develop a slightly granular surface.

2. After abrasive blasting, the concrete surface shall be thoroughly cleaned of dust.

3. Application of primer, adhesive and liner shall be in strict accordance with the manufacturer’s recommendations, as approved by the Port Construction Representative.

4. Mechanical anchors shall be placed at 12-inch centers each way after adherence of the liner to the concrete surface has been achieved. Anchors shall be placed after the adhesive system as cured for a minimum of 24 hours. The penetration of the liner by the anchor shall be sealed in accordance with the manufacturer’s recommendations.
G. Nonskid Surfaces: Surfaces of liner, shown on the Drawings to be nonskid, shall be treated as follows prior to installation:

1. The liner shall be cleaned, dried, and spread with an adhesive coating recommended by the manufacturer of the liner plate.
2. The surface shall then be liberally sprinkled with clean, dry, well graded sand, all of which will pass a No. 30 sieve but be retained on a No. 70 sieve.
3. After the sanded surface has thoroughly dried, excess sand shall be brushed away and a seal coat of the adhesive coating shall be sprayed over the sand in sufficient quantity to coat and bond the sand to the liner plate.
4. The coated sand surface shall be allowed to dry thoroughly before handling.

H. Protection and Repair of Liner.

1. Necessary measures and precautions shall be taken to prevent damage to liner from equipment and materials used in or taken through the Work. Any damage to installed liner plate shall be repaired by the Contractor in accordance with the requirements for repair of the liner.
2. Nail and tie holes and cut, torn and seriously abraded areas in the liner plate shall be patched. Patches made entirely with welding strip shall be fused to the liner over the entire patch. The use of this method is limited to patches which can be made with a single welding strip. The use of parallel, overlapping or adjoining welding strips will not be permitted. Larger patches may consist of smooth liner over the damaged area, with edges covered with welding strips fused to the patch and to the liner adjoining the damaged area. The size of a single patch of the latter type shall be limited only as to its width, which shall not exceed 4 inches.
3. Whenever liner is not properly anchored to concrete, or whenever patches larger than those permitted above are necessary, the repair of the liner and the restoration of anchorage shall be accomplished by injecting epoxy grout behind the liner plate by a method approved by the Port Construction Representative. The use of adhesives will not be allowed to repair improperly anchored liner plate.

I. Field Tests:

1. Upon completion of the installation, the surface of liner shall be cleaned to permit visual inspection and spark testing by the Port Construction Representative, using a spark-type detector complying with the requirements for Spark Test. Areas of liner failing to meet the field test shall be properly repaired and retested.
2. The Contractor shall assist in the inspection and spark testing by providing adequate ventilation, ladders for access, barricades or other traffic control devices, and shall be responsible for opening and closing entrances and exits.
3. Any spark testing of liner by the Contractor shall be done with a detector complying with these Specifications.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the General and Special Conditions, this section includes ductile iron pipe and fittings for water mains, water distribution systems, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.2 RELATED SECTIONS

Section 33 11 13.01 - Water Mains

Section 33 11 51.00 - Polyethylene Wrap

Section 33 14 00.00 - Hydrostatic Testing of Pipelines

1.3 REFERENCES

ANSI A 21.10 (AWWA C 110) - Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in., for Water and Other Liquids.


ANSI A 21.50 (AWWA C 150) - Thickness Design of Ductile-Iron Pipe.

ANSI A 21.51 (AWWA C 151) - Ductile-Iron Pipe, Centrifugally Cast for Water and Other Liquids.

ANSI A 21.53 (AWWA C 153) - Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for water service.


AWWA C 600 - Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.

1.4 MEASUREMENT AND PAYMENT

A. There shall be no separate payment for the Ductile Iron Pipe and Fittings specified in this section. Include cost in unit price for work included as specified in the following sections:
1. Section 33 11 13.01 - Water Mains
2. Section 33 30 00.00 – General Sanitary Sewers
3. Section 33 34 00.00 – Sanitary Utility Sewerage Force Mains
4. Section 33 40 00.00 – Storm Drainage Utilities

1.5 SUBMITTALS

A. Contractor shall provide submittals in conformance with the requirements of the General and Special Conditions.

B. Submit shop drawings showing design of pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings. Production of pipe and fittings prior to review by Port Construction Representative is at Contractor’s risk.

1.6 QUALITY CONTROL

A. Provide manufacturer's certifications that all ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.

B. Provide certifications that all pipe joints have been tested and meet requirements of ANSI A 21.11.

PART 2 PRODUCTS

2.1 DUCTILE IRON PIPE

A. Ductile Iron Pipe Barrels: ANSI A 21.15, ANSI A 21.50 or ANSI A 21.51; bear mark of Underwriters' Laboratories approval; minimum thickness Class 51 for water mains and Class 52 for sanitary sewers, or as shown on Drawings. Provide minimum thickness Class 53 for flanged pipe.

B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

2.2 JOINTS

A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.15 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, bolts shall conform to requirements of AWWA C 111.

B. Where restrained joints for buried service are required by Drawings, provide one of the following, or approved substitution:

2. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.
3. TR-Flex Joint by U.S. Pipe and Foundry Company.
C. Threaded- or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 33 14 00.00 - Hydrostatic Testing of Pipelines.

E. Where ductile iron water main is cathodically protected from corrosion, bond rubber gasketed joints as shown on Drawings to provide electrical continuity along entire pipeline, except where insulating flanges are required by Drawings.

2.3 GASKETS

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material; for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed pipeline, shall have the following gasket materials for the noted contaminants:

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Gasket Material Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other contaminants</td>
<td>As recommended by the pipe manufacture</td>
</tr>
</tbody>
</table>

2.4 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they serve.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI A 21.10; ANSI B 16.1 cast or ductile iron. Flanges: ANSI B 16.1, Class 125; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11 (AWWA C 110); pressure rated at 250 psi.

E. Ductile Iron Compact Fittings for Water Mains: ANSI A21.53; 4-inch through 12-inch diameter; cement-mortar lining; conform to requirements of Section 33 11 51.00 - Polyethylene Wrap.

2.5 COATINGS AND LININGS

A. Water Main Interiors: ANSI A21.4, cement lined with seal coat.

C. Polyethylene Wrap: For buried water lines, including point repairs, provide polyethylene wrap unless otherwise specified or shown. Provide polyethylene wrap for buried ductile iron pipe, including polyurethane coated pipe. Conform to requirements of Section 33 11 51.00- Polyethylene Wrap.

D. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or approved substitution, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

E. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer as resistant to the contaminants identified in the Phase II Environmental Site Assessment Report.

2.6 MANUFACTURERS

A. Pre-approved manufacturers of ductile iron pipe are American Cast Iron Pipe Co., McWayne Cast Iron Pipe Co., and U. S. Pipe and Foundry Co.

PART 3 EXECUTION

3.1 INSTALLATION

A. Conform to installation requirements of Section 33 11 13.01 - Water Mains.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install all ductile iron pipe in polyethylene wrap, unless cathodic protection is provided. Do not use polyethylene wrap with a cathodic protection system.

3.2 GRADE

A. Unless otherwise specified on Drawings, install ductile iron pipe for water service to clear utility lines with following minimum cover:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Depth of Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Inches)</td>
<td>(Feet)</td>
</tr>
<tr>
<td>16 and 24</td>
<td>5</td>
</tr>
<tr>
<td>12 and smaller</td>
<td>4</td>
</tr>
</tbody>
</table>

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 51 40.00 Add – DISINFECTION OF WATER LINES

PART 1  GENERAL

1.1  SECTION INCLUDES

Subject to the General and Special Conditions, this section includes disinfection of potable water lines.

1.2  RELATED SECTIONS

Section 33 11 13.01 – Water Mains

1.3  REFERENCES

A.  AWWA C 651 - Disinfecting Water Mains

1.4  MEASUREMENT AND PAYMENT

A.  No separate payment will be made for Disinfection of Water Lines under this Section. Include cost in unit price of water lines being disinfected.

B.  No separate payment will be made for subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction.

PART 2  PRODUCTS  (Not Used)

PART 3  EXECUTION

3.1  CONDUCTING DISINFECTION

A.  Water lines constructed shall be promptly disinfected before any tests are conducted on water lines and before water lines are connected to the City of Pasadena’s water distribution system.

B.  Water for disinfection and flushing will be furnished by the Contractor.

C.  The Contractor shall conduct required disinfection operations.

D.  Contractor shall coordinate chlorination operations through the Port Construction Representative. Contractor shall notify the Port Construction Representative a minimum of 48 hours before disinfection work is to be performed.
3.2 PREPARATION

A. Use required temporary blind flanges, cast-iron sleeves, plugs, and other items needed to facilitate disinfection of new mains prior to connection to Port of Houston Authority water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.

B. Fire hydrants shall be used as blow-offs to flush newly constructed water lines 8-inch diameter and above. Where fire hydrants are not available on water lines, locations and designs for blow-offs shall be as indicated on Drawings. Install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in a manner approved by the Port Construction Representative. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.

D. Excavations shall be backfilled immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of main to facilitate flushing of dead-end water mains. Install permanent blow-off valves according to Drawings.

3.3 DISINFECTION BY CONTRACTOR

A. The Contractor shall follow the procedures outlined below when conducting disinfection operations:

1. Use not less than 100 parts of chlorine per million parts of water.

2. Introduce chlorinating material to water lines in accordance with AWWA C 651.

3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.

4. Open and close valves in lines being sterilized several times during contact period.

5. If a chemical compound is used for a sterilizing agent, it shall be placed in pipes as directed by the Port Construction Representative.

3.4 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines, bacteriological tests will be performed by an independent testing laboratory employed by the Port of Houston Authority in accordance with Material Testing in the General Conditions. If test results indicate need for additional disinfection of water lines, Contractor shall assist the Port of Houston Authority with additional disinfection operations.
3.5 COMPLETION

A. Upon completion of disinfection and testing, remove risers, except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 33 71 19.00 Add – ELECTRICAL MANHOLE AND HANDHOLE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes specifications for electrical manhole and handhole.

1.2 REFERENCES

A. The publications listed below form a part of this specification section to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ACI International (ACI):

B. American National Standards Institute (ANSI):

C. ASTM International (ASTM):

D. National Fire Protection Association (NFPA):

E. Refer to Electrical Manhole and Handhole Details drawing for additional requirements.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Cast-In-Place manholes.
   2. Precast manhole.
B. Product Data:
1. Precast concrete structures.
2. Manhole frames and covers.
3. Sealing material for precast manhole joints.
4. Cable racks, arms and insulators.

1.4 QUALITY ASSURANCE
A. Precast Manhole: Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:
1. Material description.
2. Manufacturer’s printed assembly and installation instructions.
3. Design calculations.
4. Reinforcing shop drawings.
5. Plans and elevation showing opening and pulling-in iron locations and details.
B. Pre-cast manholes and handholes are the standard method of construction. Cast-in-place construction is permitted only where conditions require cast-in-place construction and where pre-approved in writing by Port Construction Representative.

1.5 MEASUREMENT AND PAYMENT – NEW CONSTRUCTION
A. Payment for installing new ‘Manhole Type A,B,C,D’ and ‘Handhole Type A,B,C,D’ shall be on a unit price basis, per Each manhole or Each handhole, for material, labor, equipment, appurtenances per drawings, and all other incidentals required, complete in place and accepted.

1.6 MEASUREMENT AND PAYMENT – MANHOLE REHABILITATION (REPLACE RACKS)
A. Payment for ‘Replace Racks’ shall be on a unit price basis, per Each manhole, for material, labor, equipment, and all other incidentals required, complete in place and accepted.
B. Expected quantities are shown on plan sheet E-169A. Quantities on the bid form may exceed expected quantities to allow for unforeseen conditions.

PART 2 PRODUCTS
2.1 MATERIALS AND EQUIPMENT
A. Underground Structures:
1. Cast-In-Place Concrete Manholes: Smooth trowel finish for floors and horizontal surfaces. Concrete shall conform to Section 03300 – “Concrete Construction.” Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers.
2. Precast Concrete Manholes, Risers, and Tops: In accordance with ASTM C 478, except that the spacing of manhole steps or ladder rungs shall not exceed 16 inches. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete manholes.
3. Manholes: Provide type indicated. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers shall fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cast the words “Electric” in the top face of power manhole covers except, where shown otherwise on plans. Cable racks, including rack arms and insulators and cable tray, shall be adequate to accommodate the cables.

4. Metal Frames and Covers: Provide cast iron frames and covers for manholes and handholes.

C. Cable Racks, Arms and Insulators: Metal portion of racks and arms shall be zinc-coated after fabrication.
   1. Cable Racks: See drawings for type and description.
   2. Rack Arms: Cable rack arms shall be stainless steel or non-metallic (i.e. glass reinforced nylon) and shall be of the removable type.
   3. Mounting hardware shall be stainless steel, grade 316 or better, grade 303 or better for anchors embedded in concrete.
   4. Insulators: Insulators for metal rack arms shall be dry-process glazed porcelain. Insulators are not required for non-metallic arms.

D. Cast-In-Place Manholes: Cast-in-place reinforced concrete manholes shall be as indicated. Floor surfaces shall have a steel trowel finish. The complete manholes shall be Airport Loading (100 kips min.). Covers shall fit frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from warp and blow holes that may impair strength or appearance. Exposed metal shall have smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. The words “Electric” shall be cast in the top face of power manhole covers unless shown otherwise on plans.

   1. Optional Precast Concrete Construction: In lieu of cast-in-place concrete manholes, the Contractor may, provide precast concrete structures, subject to the requirements specified below. Precast units shall be the product of a Manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes and hand holes.

       a. General: Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have an ultimate 28 day compressive strength of not less than 30 MPa, 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the Manufacturer in accordance with the requirements.
specified. Structures shall be identified with the Manufacturer’s name embedded in or otherwise permanently attached to an interior wall face.

b. Construction structure top, bottom, and wall shall be of a uniform thickness of not less than 12 inches for walls and 19 inches for tops. Thin-walled knock-out panels designed for future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed and cast completely open by the precaster. Size of windows shall exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two (2) No. 4 bars around window openings. The minimum concrete cover for reinforcing steel shall be 2 inches. Provide drain sumps for precast structures a minimum of 12 inches in diameter and 4 inches deep. See Electrical Manhole and Handhole Details drawing for additional requirements.

c. Joints: Provide tongue-and-groove or shiplap joints on mating edges of precast components. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to ASSHTO M 198, Type B. Install sealing material in strict accordance with the Sealant Manufacturer’s printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2. Metal Frames and Covers: Shall be made of ductile iron and shall meet requirements of FS RR-F-621 and shall be rated for “Airport Loading (100 kips min.).”

3. Pulling-In Irons: Shall be steel bars bent in the form indicated and cast in the walls and floors. In the floor they shall be centered under the cover and in the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manhole. Pulling-in irons shall project into the manhole approximately 4 inches. Iron shall be hot-dipped galvanized after fabrication.

4. Cable Racks: Including rack arms and insulators, shall be sufficient to accommodate the cables. Racks in power manholes shall be spaced not more than 3 feet apart, and each manhole wall shall be provided with a minimum of two (2) racks. The wall bracket shall be stainless steel or non-metallic (i.e. glass reinforced nylon) material. Slots for mounting cable rack arms shall be spaced at 8 inch intervals.

5. Rack Arms: Cable rack arms shall be stainless steel or non-metallic (i.e. glass reinforced nylon) material and shall be of the removable type.

6. Mounting hardware shall be stainless steel, grade 316 or better, grade 303 or better for anchors embedded in concrete.

8. Grounding in Manholes: Provide No. 6 AWG bare copper grounding pigtails on walls of each manhole. The pigtails shall be exothermically welded to the reinforcing bars and shall extend at least 8 inches into manhole. Two (2) pigtails shall be provided in each manhole.

9. Precast Manhole and Handhole Installation: Commercial precast assemblies shall be set on 12 inches of level cement stabilized sand, extending outward to the limit of the excavation for the structure. Additionally, assemblies shall be backfilled with cement stabilized sand to a level equivalent to the top of the highest penetrating duct.

10. Field Painting: Cast-iron frames and covers not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coast of bituminous paint. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surface shall be primed with a coat of primer and one (1) coat of synthetic exterior gloss enamel unless shown otherwise on plans.

E. Metal Frames and Covers: All handhole and manhole frames, covers and structures located in paved areas shall be rated for Airport Loading (100 kips min.).

PART 3 EXECUTION

3.1 INSTALLATION

A. Contractor Damage: The Contractor shall promptly repair any utility lines, piping, or other underground structures or systems damaged by Contractor operations. In any event, the Contractor shall immediately notify the Port Construction Representative of any such damage.

B. Concrete: Concrete work for electrical ductbanks shall be Class E as described in Section 03 30 00.00 – Cast-in-Place Concrete”. Slump shall not exceed 3 inches. Retempering of concrete will not be permitted. Exposed, unformed concrete surfaces shall be given a smooth, wood float finish. Concrete shall be cured for a period of not less than 7 days., Patching honeycombed or otherwise defective areas with cement mortar as directed by the Port Construction Representative is to be made with high early strength Portland cement concrete. Air entrain concrete exposed to weather using and air-entraining admixture conforming to ASTM C 260. Air content shall be between 4 and 6 percent.

C. Cast-In-Place Manholes: Underground structure(s) shall be cast in place using Class C concrete as described in Section 03 30 00.00 – "Cast-in-place Concrete" or may be of precast construction as specified herein. Horizontal concrete surfaces of floors shall have a smooth finish. Cure concrete by applying two (2) coats of white pigmented membrane.
forming-curing compound in strict accordance with the Manufacturer’s printed instructions. Curing compound shall conform to ASTM C 309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures shall fit the frames without undue play. Steel and iron shall be formed to shape and size with sharp lines and angles. Castings shall be free from wrap and blow holes that may impair strength or appearance. Exposed metal shall have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. The works “Electric” shall be cast in the top face of power manhole covers unless shown otherwise on plans.

D. Optional Precast Concrete Construction:

1. Optional Precast Concrete Construction: In lieu of cast-in-place, the Contractor may, at his option, provide precast concrete manholes, subject to the requirements specified below. Precast units shall be the product of a Manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes. See Electrical Manhole and Handhole Details and see Electrical Manhole and Handhole Reinforcement Details drawings for additional requirements.

a. General: Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work shall have an ultimate 28 day compressive strength of not less than 4000 psi, and may be steam cured. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the Manufacturer in accordance with the requirements specified. Structures shall be identified with the Manufacturer’s name embedded in or otherwise permanently attached to an interior wall face.

b. Design for precast structures: In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

1) Angle of internal friction (phi): 30 degrees.
2) Unit weight of soil (dry): 110 pcf.
3) Unit weight of soil (saturated): 130 pcf.
4) Coefficient of lateral earth pressure (Ka): 0.33.
5) Vertical design loads shall include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads shall consider all types and magnitudes of vehicular (automotive or industrial) traffic to be encountered. Minimum design vertical load shall be for Airport Loading (100 kips min.).

6) Horizontal design loads shall include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads
imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, shall be considered along with a pulling-in iron design load of 6000 pounds.

7) Each structural component shall be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

8) Design shall also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

c. Construction: Structure top, bottom, and wall shall be of a uniform thickness of not less than 12 inches for walls and 19 inches for top. Thin-walled knock-out panels for designed or future duct bank entrances shall not be permitted. Quantity, size, and location of duct bank entrance windows shall be as directed and cast completely open by the precaster. Size of windows shall exceed the minimal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct misalignment. However, the sides of precast windows shall be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two (2) No. 4 bars around window openings. Minimum concrete cover for reinforcing steel shall be 2 inches. Provide drain sumps for precast structures a minimum of 12 inches in diameter and 4 inches deep. See Electrical Manhole and Handhole Details drawing for additional requirements.

d. Joints: Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip. Install sealing material in strict accordance with the Sealant Manufacturer’s printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2. Metal Frames and Covers for Handholes: Shall be made of ductile iron and shall meet requirements of FS RR-621, and shall be rated for “Airport Loading (100 kips min.)”. Covers shall be rated at 130 kips.

3. Pulling-In Irons: Shall be steel bars bent in the form indicated and cast in the walls and floors. In the floor they shall be centered under the cover and in the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manhole. Pulling-in irons shall project into the manhole approximately 4 inches. Iron shall be hot-dipped galvanized after fabrication.
11. Cable Racks: Including rack arms and insulators, shall be sufficient to accommodate the cables. Racks in power manholes shall be spaced not more than 3 feet apart, and each manhole wall shall be provided with a minimum of two (2) racks. The wall bracket shall be stainless steel or non-metallic (i.e. glass reinforced nylon) material. Slots for mounting cable rack arms shall be spaced at 8 inch intervals.

4. Slots for mounting cable rack arms shall be spaced at 8 inch intervals.

5. Rack Arms: Cable rack arms shall be stainless steel or non-metallic (i.e. glass reinforced nylon) material and shall be of the removable type.

6. Mounting hardware shall be stainless steel, grade 316 or better, grade 303 or better for anchors embedded in concrete.


8. Grounding in Manholes: Provide No. 2 AWG bare copper grounding pigtails on walls of each manhole. The pigtails shall be exothermically welded to the reinforcing bars and shall extend at least 8 inches into manhole. Two (2) pigtails shall be provided in each manhole.

9. Precast Manholes Installation: Commercial precast assembly shall be set on 12 inches cement stabilized sand as specified in Section 2710, extending on each side to the limits of the excavation for the structure.

10. Field Painting: Cast-iron frames and covers not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coat of bituminous paint. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surface shall be primed with a coat of primer and one (1) coat of synthetic exterior gloss enamel unless shown otherwise on plans.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

CONSTRUCT CONTAINER YARD 6 NORTH AT BAYPORT TERMINAL

SECTION 35 40 10.00 Add – TIMBER BENTS

PART 1 – GENERAL

1.1 SUMMARY
Section includes requirements for installing timber bents on outfall pipes.

1.2 MEASUREMENT AND PAYMENT
A. No separate payment shall be made for work under this section. Include price of timber bent in the unit price of item for which timber bent is a component.

1.3 REFERENCES
A. ASTM A 153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
B. ASTM A 307 – Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
C. AWPA C2 – Lumber, Timbers, Bridge Ties and Mine Ties – Preservative Treatment by Pressure Processes.
D. AWPA C4 – Poles – Preservative Treatment by Pressure Processes.
E. AWPA P1/P13 – Standard for Coal Tar Creosote for Land, Fresh Water and Marine (Coastal Water) Use.
G. SPIB Section 300 – National Grading Rule (NGR) for Dimension Lumber.

1.4 SUBMITTALS
A. Provide manufacturer’s product specifications and certification that timber members meet or exceed the standards referenced in this Section.

PART 2 – PRODUCTS

2.1 TIMBER PILES
A. Provide southern pine wood poles for use as timber bent piles that meet the requirements of ANSI O5.1.
   1. Provide minimum diameter of 8 inches at the pile tip.

B. Provide southern pine wood poles that are pressure preservative treated in accordance with AWPA C4 using one of the following methods:
   1. Creosote conforming to AWPA P1/P13 to 9.0 pounds per cubic foot (pcf) by assay.
2. Chromated copper arsenate (CCA – Type C) oxide preservative to produce a retention assay of 0.6 pounds per cubic foot.

2.2 TIMBER MEMBERS
   A. Provide southern pine timber members meeting SPIB Section 300 – National Grading Rule for Dimension Lumber, Select Structural (SEL STR) Grade No. 2 or better.
   
   B. Provide pressure preservative members treated per AWPA C2 for Soil and Fresh Water Use with one of the following methods:
      1. Creosote conforming to AWPA P1/P13 to 10.0 pounds per cubic foot by assay.
      2. Chromated copper arsenate (CCA – Type C) oxide preservative to produce a retention assay of 0.6 pounds per cubic foot.

2.3 HARDWARE
   A. Provide bolts conforming to ASTM A 307.
   B. Provide hot dipped galvanized hardware in accordance with ASTM A 153.

PART 3 – EXECUTION
3.1 INSTALLATION
   A. Drive piles to the depth shown on the Plans.
   B. Bolts:
      1. Drill holes no more than 3/16 inch larger in diameter than the bolts being used. Drill holes straight and true. Drill bolt holes in center of the pile and timber member.
      2. Use washers under bolt head and nut to prevent direct bearing of head or nut on wood.

END OF SECTION
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Welders - Receive rate prescribed for craft performing operation to which welding is incidental.

DOL Ref#TX20030048
State: Texas
Construction Types: Highway
Counties: Brazoria, Chambers, Fort Bend, Galveston, Hardin, Harris, Jefferson, Liberty, Montgomery, Orange and Waller Counties in Texas.

HIGHWAY CONSTRUCTION PROJECTS (excluding tunnels, building structures in rest area projects, and railroad construction; bascule, suspension & spandrel arch bridges; bridges designed for commercial navigation; bridges involving marine construction; other major bridges).

Asphalt Distributor Operator

Drives distributor truck, sets spray bars and operates valves and levers to control distribution of bituminous material for highway surfacing. May oil, grease or otherwise service and make adjustments to equipment as needed. Performs other related duties.

Asphalt Paving Machine Operator

Operates paving machine that spreads and levels asphaltic concrete on highway subgrade. Controls movement of machine, raises and lowers screed, regulates width of screed. May, oil, grease, service and make adjustments to equipment as needed. Performs other related duties.

Asphalt Raker

Distributes asphaltic materials evenly over road surface by raking and brushing material to correct thickness; directs Laborers when to add or take away material to fill low spots or to reduce high spots. Performs other related duties.

Asphalt Shoveler

A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms, may help set and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

Broom or Sweeper Operator

Operates a self-propelled machine to sweep and clean roadway surfaces. May oil grease, service and make adjustments to equipment as needed. Performs other related duties.

Bulldozer Operator

Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material. May operate a ripper attachment to break up rock or other hard material. May use a push block on front of tractor to push load scrapers. May oil grease, or otherwise service and make minor repairs to equipment as needed. Performs other related
Carpenter (Rough)

Works from plans to build, assemble, fit together, align, plum, and set in place forms for molding concrete structures. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks form while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools. Performs other related duties.

Concrete Finisher (Paving)

Finishes the exposed surfaces of fresh concrete paving, median barrier and every element of concrete structures to the final grade and contour structures to the final grade and contour with the use of straight edges and steel trowels. Operates bridge deck finishing machine. Finishes concrete curbs and gutters. Finishes exposed surface of concrete after forms have been removed by patching imperfections with fresh concrete, rubbing surface with abrasive stone, and directing others in removing excess or defective concrete with power tools. Performs other related duties.

Concrete Finisher (Structures)

A worker semi-skilled in concrete finishing who assists Concrete finisher by performing specific or general duties of lesser skill and keeping Concrete Finisher supplied with materials, tools, and supplies; cleaning working area an equipment; and holding materials and tools. Performs other related duties.

Concrete Paving Curbing, Machine Operator

Operates self-propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

Concrete Paving Finishing, Machine Operator

Operates self-propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

Concrete Paving Joint Sealer, Operator

Cleans and seals joints requiring a hot or cold sealing compound in concrete paving, sidewalks, driveway and approach slabs. May oil, grease or make necessary repairs adjustments to equipment as needed. Performs other related duties.

Concrete Paving Saw Operator

Operates a water-cooled power saw with either or an abrasive blade to saw expansion and contraction joints in concrete paving. May also be used to saw asphaltic pavements. May oil grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Concrete Paving Spreader, Operator
Operates self-propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

**Concrete Rubber**

Finishes the exposed surface of concrete masonry after the forms have been removed by patching holes and broken corners with fresh concrete, rubbing surface with abrasive stone to remove rough spots, and removing high spots and defective concrete with hand chisel and hammer or pneumatic chisel and powered abrasive stone. Performs other related duties.

**Crane, Clamshell, Backhoe, Derrick, Dragline, Shovel Operator**

A worker who operates a lattice boom type crane can hoist and move materials, raise and lower heavy weights and perform other related operations. May be crawler type or rubber tired. May include placement of rock riprap, clamshell, dragline, pipe and pile driving operations. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Crusher and Screed Plant Operator**

Operates a crusher or screening plant through which rock is run to break it into crushed stone for construction or to control flow of materials not needed. May include minor repairs and may service and make necessary adjustments to equipment as needed. Performs other related duties.

**Electrician**

Plans and directs the layout of metal electrical conduit, installs wiring systems, switch-panels, buss bars, works on overhead distribution systems and underground distribution systems. Performs other related duties.

**Flagger**

A worker who directs traffic in or around a construction site. May use signs or devices to direct traffic. May help assemble, position and clean devices or equipment used to direct traffic. Must be able to effectively communicate with the public. May require certain level of training by TXDOT specifications. Performs other related duties.

**Form Builder/Setter (Structures)**

Works from plans to build, assemble, fit together, align, plum, and set in place forms for molding concrete structures. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks forms while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools. Performs other related duties.

**Form Liner (Paving & Curb)**

Fits together, aligns and sets to grade metal and wooden forms for placement of concrete paving and curbs. Works with survey crew to set stringline for paving, curb, and gutter curb. Performs other related duties.

**Form Setter (Paving & Curb)**
Fits together, aligns and sets to grade metal and wooden forms for placement of concrete paving and curbs. Works with survey crew to set stringline for paving, curb, and gutter curb. Performs other related duties.

**Foundation Drill Operator, (Crawler Mounted)**

Operates a hole-drilling machine that is crawler mounted. May include geotechnical operations such as soils nails, rock nails, tiebacks, anchors and jet grouting. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Foundation Drill Operator, (Truck Mounted)**

Operates a hole drilling machine that is mounted on the rear of a rubber tired vehicle or truck. May include soils nails, rock nails, tiebacks, anchors and jet grouting. Drive truck from location to location or may have laborer who drives truck. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Front End Loader Operator**

Operates a rubber tired, skid steer or crawler type tractor with an attached scoop type bucket on front end. Machine is used to load materials from stockpiles, excavation, charging batch plants, loading and unloading trucks. May be used with attachments in lieu of the bucket. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Laborer, Common**

A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms, may help set and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

**Laborer, Utility**

Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill, and may later become a helper in a specific classification. Performs other related duties.

**Manhole Builder**

Constructs a means of permanent access to water and sewer lines for maintenance purposes. This work consists of laying brick or concrete slab at bottom of ditch up to an approximate grade line near the surface of the ground. Brick or block is normally laid to form a nearly
circular manhole. Brick or block is laid in by eyesight and is normally to a plumb line. Chipped or culled brick can be used quite often is. No effort may be made to keep mortar off the face of the brick and joints are not pointed. May apply coating of concrete to interior and exterior surface. Performs other related duties.

Mechanic

Assembles, set up, adjusts and maintains and repairs all types of construction equipment and trucks. He may perform the duties of a welder in repair of equipment. Performs other related duties.

Milling Machine Operator, (Fine Grade)

Operates a power-driven milling machine that planes material of the to roadbed and discharges the material into a hauling unit or a windrow. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Mixer Operator

Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill, and may later become a helper in a specific classification. Performs other related duties.

Motor Grader Operator (Rough)

Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Motor Grader Operator

Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Oiler

A learner or semi-skilled worker who under the direction of the watch engineer May oil and grease or otherwise service all engines and necessary equipment as needed. He may clean and paint engine room as needed. Performs other related duties.

Painter (Structures)
Paints and stains structural steel and concrete surfaces of bridges, retaining walls, or other structures. Directs cleaning and abrasive blasting of surfaces prior to painting or staining. Performs other related duties.

**Pavement Marking Machine, Operator**

Operates machine used in laying paint stripes or markers on all types of paving. Loads machine with appropriate materials and may walk or ride on machine. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Piledriverman**

Sets in place, aligns, plumbs directs driving of timber, concrete, steel, pipe and any other type of piling. Sets, drives and pulls steel, concrete and other types of sheet piling. Rigs pile and leads and bracing. Signals operator. Splices piles before and after driving. Directs pile cutoff. May direct jetting or drilling equipment in connection with installing piles to grade. Performs other related duties.

**Pipelaye**

Installs concrete, clay, steel, ductile iron, plastic, corrugated pipe and any other type of pipe for storm drainage, water lines, gas lines and sanitary sewer lines. Lays underground communication and electrical ducts. May install and set electrical ground boxes, hand holes, manholes, inlets and other structures. Caulks joints, make threaded and flanged connections. Installs valves and other accessories. Performs other related duties.

**Reinforcing Steel Setter, (Paving)**

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

**Reinforcing Steel Setter, (Structure)**

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

**Roller Operator, Pneumatic, (Self-Propelled)**

Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Roller Operator, Steel Wheel, Flat Wheel/Tamping**

Operates a self-propelled machine with either steel wheels or pneumatic tires which is used to compact earth fills, subgrade, flexible base and all other types of materials except bituminous. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
Roller Operator, Steel Wheel, Plant Mix Pavement

Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Scraper Operator

Operates a self-contained wheeled tractor scraper both self loading or assisted by crawler tractors or other scrapers. Used to excavate and transport earth or other materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Servicer

Drives a truck, which carries various fuels, oils, greases and filters. Must have knowledge of and is responsible for the correct oiling and greasing and changing of filters on equipment according to the manufacturers' specifications. Uses compressed air grease guns, wrenches and other tools. May make adjustments to clutches, brakes and other mechanical items. Keeps record of service preventive maintenance records. May have laborer assisting him. May require CDL if driving truck on public highways. Performs other related duties.

Sign Installer (PGM)

Sets forms, reinforcing steel, anchor bolts and pours concrete for Sign foundations. Fabricates and erects pipe and angle Frameworks by bolting, welding or other means prior to installation of signs that are normally prefabricated. Works from plans in location and drilling holes for proper location and alignment of signs. May direct hoisting of signs into place. Fastens signs to framework by bolting and other means. Locates and sets lighting brackets. May perform other work associated with signing projects. Supervises sign erector helper. Performs other related duties.

Slip Form Machine Operator

Cleans and seals joints requiring a hot or cold sealing compound in concrete paving, sidewalks, driveway and approach slabs. May oil, grease or make necessary repairs adjustments to equipment as needed. Performs other related duties.

Spreader Box Operator

Operates spreader box by adjusting hopper and strike off blade so that the gravel, stone or other material may be spread to a specific depth on road surface during seal coat and surface treatment operations. May oil, grease or other wise service and make necessary adjustments to equipment as needed. Performs other related duties.

Structural Steel Worker

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

Tractor operator (Crawler Type)

Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material. May operate a ripper attachment to break up rock or other hard
material. May use a push block on front of tractor to push load scrapers. May oil grease, or otherwise service and make minor repairs to equipment as needed. Performs other related duties.

**Tractor operator, Pneumatic**

Operates a gasoline or diesel powered agricultural tractor that tows compaction rollers, plow, disc. water tanks, scrapers and other similar operations. May use other miscellaneous attachments. May oil. Grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Traveling Mixer Operator**

Drives a gasoline or diesel truck upon which is mounted a concrete mixer. Operates concrete mixer and dumps concrete on the grade, into forms or into concrete pumps or buckets. Cleans mixer drum. May require CDL license for on highway use. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

**Truck driver, Lowboy-Float**

Drives a heavy-duty diesel powered truck to which is attached a trailer upon which heavy equipment is hauled. Driver is often required to operate heavy equipment to load or unload the lowboy. May require CDL license for on highway use. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

**Truck driver, Single Axle, (Heavy)**

Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May services and make necessary adjustments for proper operation equipment. Performs other related duties

**Truck driver, Single Axle, (Light)**

Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May services and make necessary adjustments for proper operation equipment. Performs other related duties

**Truck Driver (Tandem Axel Semi-Trailer)**

Drives a diesel-powered tractor pulling a semi trailer hauling materials. Hauls dirt, rock, aggregates or other material. May require CDL license for driving on highway. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

**Work Zone Barricade Servicer**

Fabricates, erects and maintains temporary traffic control devices, including arrow boards, signs, barricades, channelizing devices, barrels and all message boards. May operates a truck during traffic control operations.

**Welders - Receive rate prescribed for craft performing operation to which welding is incidental.**