GENERAL NOTES

1. COMPACTED CH, CL, SC "IMPERVIOUS FILL" PER EMBANKMENT CONSTRUCTION SPECIFICATION 31 24 00 2.02C. BERM WILL BE OVERBUILT IN ORDER TO ARCHIVE DESIGN GRADE AFTER SETTLEMENT AND CONSOLIDATION.

2. SUITABLE MATERIAL PER EMBANKMENT CONSTRUCTION SPECIFICATION 31 24 00 2.02C.

PORT OF HOUSTON AUTHORITY

HOUSTON SHIP CHANNEL (HSC)
EXPANSION CHANNEL IMPROVEMENT PROJECT (ECIP)
PROJECT 11
PACKAGE #7

SEGMENT 3 - BARBOURS CUT CHANNEL, SPILMAN ISLAND BULKHEAD

TYPICAL SECTION - BERM RELOCATION

SCALE: 1"=20'

NOTE 1: 1% SLOPE OF CRANE MAT
NOTE 2: 3% SLOPE OF CONTROL Diked Area

10'-0"
20'-0"
40'-0"
60'-0"

MLLW EL 0.0'
EL +32.0'
EL +38.8'
EL +36.4'
EL +36.0'

1% SLOPE OF CRANE MAT

1% SLOPE OF BULKHEAD CUT-OFF WALL

CUT-OFF WALL

INTERIOR BERM

PERIMETER BERM

MHHW EL +1.3'

SEE NOTE 1

SEE NOTE 2

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65% REVIEW
ENLARGED PROPOSED BULKHEAD CUT-OFF WALL PILE PLAN

MATCHLINE STATION 132+50.20, SEE TOP RIGHT

GENERAL NOTES
1. REFER TO GENERAL NOTES ON SHEET G-002.
2. REFER TO SHEET C-106 FOR WORKING POINT STATION CONTROL LEGEND.
GENERAL NOTES
1. REFER TO GENERAL NOTES ON SHEET G-002.

This Document Is Released For The Purpose Of Interim Review Under The Authority Of DAVID BROYLES, P.E., 117271 8/15/20. It Is Not To Be Used For Construction, Bidding, Or Permit Purposes.
This Document Is Released For The Purpose Of Interim Review Under The Authority Of DAVID BROYLES, P.E., 117271 8/14/20. It Is Not To Be Used For Construction, Bidding, Or Permit Purposes.
SECTION B - BULKHEAD CUT-OFF WALL (STA 100+19.32 TO STA 101+34.39 & STA 106+63.57 TO STA 116+04.15)

SCALE: 1"=20'

SPILMAN ISLAND BULKHEAD

PORT OF HOUSTON AUTHORITY
MHHW EL +1.3'
TIP EL -58.0'
305'-0"±
251'-6" (VARIES AT STA 133+21.73 TO STA 135+91.78)
MLLW EL 0.0'
PROPOSED GRADE
BERM RELOCATION, TOP EL +39.0'
STEEL SHEET PILE
FUTURE TOE OF SHIP CHANNEL
24" DIA STEEL PIPE PILE
TIP EL -49.0'
PAZ30"/NZ38 STEEL PILE SYSTEM
-60.5' MLLW (FUTURE DESIGN DEPTH)
-50.5' MLLW (PROPOSED DESIGN DEPTH)
BENCH AT EL +32.0'
PORT OF HOUSTON AUTHORITY
65% REVIEW
HOUSTON SHIP CHANNEL (HSC)
EXPANSION CHANNEL IMPROVEMENT PROJECT (ECIP)
PROJECT 11
PACKAGE #7
SEGMENT 3 - BARBOURS CUT CHANNEL, SPILMAN ISLAND BULKHEAD
OVERALL BULKHEAD SECTIONS (4 OF 4)

SECTION D - BULKHEAD CUT-OFF WALL (STA 126+42.96 TO STA 135+91.78)

ENLARGED DETAIL "B"

65% DRAFT
# PORT OF HOUSTON AUTHORITY

## TECHNICAL SPECIFICATIONS FOR

**HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT**

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

**List of Project Specifications- 65% Submittal**

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TECHNICAL SPECIFICATIONS

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 01 71 23.16 Add – CONSTRUCTION SURVEYING

PART 1- GENERAL

1.01 SUMMARY

Construction Surveying includes furnishing materials, labor, and equipment for topographic where required under the Contract Documents.

1.02 RELATED SECTIONS

Section 01 22 10.00 Std – Measurement of Quantities
Section 31 24 00 Add – Embankment Construction

1.03 REFERENCES

Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.


1.04 SUBMITTALS

A. Engineer’s approval is required for submittals with an “E” designation; submittals not having an “E” designation are for information only. The following shall be submitted in accordance with Section 01 33 00, “Submittal Procedures”:

1. Name of Registered Professional Land Surveyor (Paragraph 1.05 A)
2. Surveying Plan (Paragraph 1.05 B); E
3. Survey Submittal Log (Paragraph 3.02 D)
4. Upland Placement Area (PA) Dike Surveys (Paragraph 3.07); E
5. Shoreline Protection Surveys (Paragraph 3.09); E

1.05 QUALITY ASSURANCE

A. General: All survey plots submitted to Engineer shall be sealed by a professional land surveyor registered in the State of Texas, experienced in topographic surveying, and familiar and experienced with the USACE’s surveying guidelines in Engineer Manuals (EM) 1110-1-1005 and 1110-2-1003. Prior to commencing Work, Contractor shall provide name and credentials of professional land surveyor (PLS) who will oversee surveys. Use of a PLS who is certified as an American Congress on Surveying and Mapping (ACSM) Hydrographer is strongly encouraged.

B. Surveying Plan: Contractor shall provide description of methods and equipment to be applied for required surveys as well as quality control and quality assurance (QA/QC) procedures to...
be applied. No other equipment shall be used for surveying without prior notification to Engineer. Refer to Paragraph 3.08.B for additional QA/QC requirements for multi-beam surveys.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

Contractor shall provide Initial, Interim, and Final surveys for measurement and acceptance of Work items. Plots showing lines and grades, and quantity computations, shall accompany all payment requisitions. Refer to Table 1 for a general summary of the required surveys.

3.02 SURVEY PLOTS

A. All construction surveys submitted to Engineer shall be in the form of plan-view and cross-section plots and digital data. All surveys shall be referenced to the project datums shown on the Drawings. Plots shall be transmitted digitally in PDF and AutoCAD format. All plots shall legibly and clearly display the following information:

1. Project and Owner names
2. Professional Land Surveyor's seal, signature, and business affiliation (required on pdf transmittals)
3. Date(s) surveys were performed
4. Location and description of survey control
5. Vertical and horizontal datums
6. Sheet name and number
7. Name of Contractor
8. Drawing scale(s)
9. Submittal title (e.g., “Berm Existing Grade”)
<table>
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<th>Intended Purpose</th>
<th>Submittal(s) Schedule</th>
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<td><strong>Dikes at Upland Placement Areas</strong></td>
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<tr>
<td>Initial</td>
<td>To establish baseline conditions at perimeter and interior dikes where dike improvements are required.</td>
<td>Prior to dike improvements (as applicable) and discharge of dredged material.</td>
</tr>
<tr>
<td>Interim</td>
<td>Interim surveys shall be performed to document conformance of completed portions of work for monthly progress payments.</td>
<td>With pay requests.</td>
</tr>
<tr>
<td>Final</td>
<td>To document completed condition of dike improvements and establish final pay volumes.</td>
<td>Upon completion of dike improvements, prior to discharge of dredged material.</td>
</tr>
<tr>
<td><strong>Shoreline Protection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial</td>
<td>To verify existing conditions and for review by Engineer in assessing need for any adjustments to specified templates and/or work limits prior to start of shoreline protection construction.</td>
<td>Prior to commencement of shoreline protection construction.</td>
</tr>
<tr>
<td>Interim</td>
<td>Interim surveys shall be performed to document conformance of completed portions of work for monthly progress payments.</td>
<td>With pay requests.</td>
</tr>
<tr>
<td>Final</td>
<td>Final survey shall be performed to document final lines and grades of any portions of shoreline protection not previously accepted through Interim Surveys.</td>
<td>After completion of shoreline protection (req’d prior to final payment).</td>
</tr>
</tbody>
</table>

B. Survey plots shall include the following:

1. Plan sheets clearly documenting locations, limits, and dimensions of completed Work (as applicable) and locations where cross sections were taken.

2. Cross-section sheets providing an overlay of sequential survey transects (as applicable) along with specified templates. A legend shall be provided indicating the date and survey type (e.g., Initial, Interim, Final, etc.) for each transect shown.

3. Cross-sectional areas for each section calculated by comparing the Initial/Interim/Final, as applicable surveys.

C. **Digital Data**: In addition to plots in pdf format, all survey submittals shall include digital data on labeled CD or DVD. Digital data shall include the following:

1. A submittal log documenting surveys submitted to date with descriptors for survey dates and locations.

2. AutoCAD files in “.dwg format”
3. 3D ASCII “XYZ” files

4. PDF files with signed Registered PLS seal

3.03 SURVEY TRANSECTS

A. General: The survey transects specified herein apply to all surveys of dikes and shoreline protection at upland placement areas, performed by Contractor for acceptance and/or submittal with monthly pay requests. Survey shots along each transect shall be taken at all significant grade breaks and at a maximum horizontal spacing of 20 ft.

B. Placement Areas: Where dike improvements are specified on the Drawings, survey transects shall consist of cross-sections of the dikes at 100 ft intervals extending 50 ft (min) beyond the proposed inner and outer toe.

C. Shoreline Protection: Where shoreline protection is specified on the Drawings, survey transects shall consist of cross-sections of the shoreline protection at 100 ft intervals extending 50 ft (min) beyond the outer toe of the shoreline protection, and 50 ft (min) beyond the inner toe of the dike. For sections of shoreline protection not adjacent to a dike, the cross-sections shall extend 50 ft (min) beyond the limits of the shoreline protection.

3.04 PLACEMENT AREA SURVEYS

A. Initial Survey(s): For any PAs for which dike improvements are specified on the Drawings, Contractor shall perform a topographic survey (i.e., cross-sections) along the dikes prior to construction of dike improvements.

B. Final Survey(s): For any PAs for which dike improvements are specified on the Drawings, Contractor shall perform a topographic survey (i.e., cross-sections) along the dikes after construction of dike improvements and prior to commencing discharge of dredged material in PA. Monthly surveys shall be performed during dike improvements for progress payments.

3.05 SHORELINE PROTECTION SURVEYS

A. Initial Survey: Contractor shall perform a topographic survey (i.e., cross-sections) along the specified shoreline protection alignment prior to construction of shoreline protection.

B. Interim Survey: Upon completion of excavation and grading for preparation of shoreline protection subgrade, Contractor shall perform a topographic survey (i.e., cross-sections) along the specified shoreline protection alignment at the following stages:

1. Upon completion of excavation and grading for preparation of shoreline protection subgrade (prior to placement of any fill).
2. Upon completion of excavation and grading for preparation of shoreline protection subgrade (after placement of fill).
3. After placement of bedding stone.
4. After placement of armor stone (prior to backfilling).

C. Final Survey: Contractor shall perform a topographic survey (i.e., cross-sections) along the completed shoreline protection.

1. After final backfilling and grading.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 02 22 13 Add – CONSTRUCTION VIBRATION MONITORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. SCOPE:

1. Work under this section includes, but is not limited to, pre-construction condition and topographic surveys, post construction condition and topographic surveys, and monitoring of construction-related vibration producing activities completed for this project. Vibration monitoring shall be conducted before, during and after any anticipated vibration producing activities such as, but not limited to:

   a. Demolition
   b. Site preparation and excavation activities
   c. Pile installation
   d. Sheetpile installation
   e. Operation of construction equipment, construction traffic and other activities related to new construction or rehabilitation work.

The Contractor shall provide and install the necessary equipment to monitor any potential vibrations caused by their construction operations or as directed by the Engineer.

2. Existing structures/features which may be susceptible to vibrations effects at the project site include but are not limited to:

   a.
   b.
   c.

Existing structures/features are not necessarily limited to those structures/features listed.

The Contractor shall review the existing site conditions and an on-ground project site evaluation for all structures/features which may be susceptible to vibration effects.
B. REQUIRED SUB-CONTRACTORS AND THEIR ROLES

1. Seismologist or Other Qualified Vibration Specialist

The seismologist or other approved qualified vibration specialist collects and analyzes data during the pre-construction stage of the project, and in conjunction with the Owner and Contractor uses that information to among other things, develop the monitoring plans for the existing structures/features, evaluate expected levels of construction-related vibrations on the existing structures/features and to assess means and methods for reducing potential vibrations at the existing structures/features. The data that is collected shall include baseline ground motions caused by non-construction vibration sources near the structures/features that are shown in the monitoring plan.

The seismologist or other approved qualified vibration specialist shall supervise the monitoring and recording of vibration by the vibration monitoring contractor, and shall also be required to recommend values for maximum peak particle velocities (PPV) thresholds and geographic limits of zones of influence for the existing structures/features that are identified in the monitoring plan.

The seismologist or other approved qualified vibration specialist shall prepare and submit a final report to the Owner at the completion of construction.

2. Vibration Monitoring Contractor

The vibration monitoring contractor installs monitoring equipment, routinely observes vibrations during construction, keeps records of the activities that create the vibrations, and will regularly update or inform the seismologist or other approved qualified vibration specialist and Contractor of his findings. The constant monitoring will allow the Contractor to limit the construction related vibrations on the structures/features.

3. Specialty Engineer

The Specialty Engineer performs conditions surveys of the existing structures/features prior to the Contractor’s mobilization and documents any existing damage to the structures/features that are identified in the monitoring plan. The Specialty Engineer shall prepare and submit a report to the Owner of the findings prior to start of construction.

During construction operations, the seismologist or other approved qualified vibration specialist may require that the Specialty Engineer check specific structures/features that are identified in the monitoring plan for deformations such as cracks and settlement in real time based on information provided by the vibration monitoring contractor.
The Specialty Engineer also performs post-condition surveys of the structures/features that are identified in the monitoring plan at the completion of all construction-related activities to record any changes to the conditions of the structures/features.

4. Land Surveyor

The land surveyor establishes the existing topographic, layout, and as-built surveys of the existing structures/features that are shown on the monitoring plan prior to any construction-related activities. The land surveyor also maintains monitoring as directed by the Owner and conducts a final survey at the end of the construction project to document any changes to these structures/features or topography that may be the result of the vibration-related work.

1.2 QUALITY ASSURANCE

A. SUB-CONTRACTOR QUALIFICATIONS:

1. The Contractor shall employ the services of a qualified seismologist or other approved qualified vibration specialist with verifiable previous experience of a minimum of three projects within the last five years in the installation of vibration monitoring equipment, planning, supervising or performing the required vibration-monitoring operations and interpretation of vibration data.

2. The Contractor shall employ the services of a qualified vibration monitoring firm or individual with verifiable previous experience of a minimum of three projects within the last five years in performing the required vibration-monitoring field operations during construction.

3. The Contractor shall employ the services of a Specialty Engineer who shall be a Registered Professional Civil or Structural Engineer and is a qualified inspector with the competence to observe and inspect materials, installation, and erection of components and connections that require special expertise to ensure compliance with approved construction documents and referenced standards. The Specialty Engineer shall have verifiable previous experience of a minimum of three similar projects within the last five years.

4. The Contractor shall employ the services of a Registered Professional Land Surveyor with verifiable previous experience of a minimum of three projects within the last five years in performing land surveying.

1.3 SUBMITTALS

A. PRE-CONSTRUCTION:

The Contractor shall submit the following:

1. Qualifications of the seismologist or other approved qualified vibration specialist
2. Qualifications of the vibration-monitoring Contractor
3. Qualifications of the Specialty Engineer
4. Qualifications of the land surveyor

5. A general notice prepared by the seismologist or other approved qualified vibration specialist for at least one (1) public pre-construction consultation with property owners and occupants within the zone of influence advising of the possibility of construction vibrations.

6. A pre-construction report that shall include the following:
   a. Results of the pre-construction condition survey including all records, reports, video, photographs, and recommendations for maximum peak particle velocity (PPV) threshold limits and warning limits in any of the three mutually perpendicular components of particle velocity for all structures/features surveyed that might be affected by construction-induced vibrations. A threshold limit should be recommended for each structure/feature in the zone of influence.
   b. A vibration-monitoring plan prepared by the seismologist or other qualified vibration specialist which includes, the locations and types of the seismic monitoring sensors and equipment.
   c. Pre-construction topographical survey of all structures/features within the specified zone of influence and along the project limits, as determined by the seismologist or other qualified vibration specialist.

7. The Contractor shall identify and submit for review by the Owner mitigation measures to reduce the effects of construction related vibrations within the zone of influence. The Contractor shall submit for review by the Owner a remedial action plan for the structures/features that are likely to be so affected.

B. DURING CONSTRUCTION:

The Contractor shall submit the following:

1. PPV measurement data of the monitoring activities to the Owner or the Engineer in responsible charge at the end of each work day when vibration inducing activities are conducted.
2. Topographic data of the structures/features that are identified in the monitoring plan throughout the entire project duration and as determined by the seismologist or other qualified vibration specialist.
3. Monthly photographic updates during the entire project duration.

C. POST-CONSTRUCTION:

The Contractor shall submit a vibration monitoring final report that shall include the following:

1. All vibration monitoring data associated with the specific construction activities that were observed in the field.
2. Results of the post-construction condition surveys including all records, reports, video, and photographs for items that may have been affected by construction-
induced vibrations and narratives on comparative pre-construction condition survey information.

3. Post-construction topographical survey data of all structures/features potentially impacted by the construction and that were recommended by the seismologist, and written statements of how this data compare to the pre-construction topo survey data.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. PRE-CONSTRUCTION REQUIREMENTS:

1. The seismologist or other qualified vibration specialist shall determine the predicted and maximum allowable PPV threshold values for the structures/features defined in the vibration monitoring plan based on the analysis of data gathered during the pre-construction condition survey.

2. The seismologist or other qualified vibration specialist shall establish the vibration zone of influence. A vibration zone of influence is defined as the area of land within or adjacent to a construction site, including any structures/features, that potentially may be affected by vibrations emanating from a construction activity where the PPV at the location where measured, is equal to or greater than the limiting PPV threshold value as defined in Section 1.3 (6) of this document.

3. Pre-construction Survey

a. The Contractor, through the seismologist or other qualified vibration specialist shall perform a documented pre-construction condition survey as part of determining vibration or settlement effects on any existing structures/features within the influence zone of the proposed construction activities.

b. The pre-construction condition survey shall include tape-recorded observations; videotape and still photography and sketches as needed to fully describe the existing condition of each structure/feature potentially affected by any construction induced vibrations, including the interior and exterior of any structure/feature.

c. This pre-construction condition survey shall be completed at least 30-days prior to the start of onsite activities.

d. The Contractor must perform pre-construction topographical surveys of all structures/features within the specified zones of vibration influence and of any other structures/features that are located along the project limits at the direction of the seismologist or other approved qualified vibration specialist.

e. A report shall be prepared for each structure/feature identified by the seismologist or other approved qualified vibration specialist. The report shall include all of the recorded observations.
4. Baseline Ground Motions
   a. The data that is collected shall include baseline ground motions caused by non-construction vibration sources near structures/features that are shown in the monitoring plan.
   b. Where predicted PPVs are anticipated to exceed the determined threshold, the seismologist or other qualified vibration specialists shall establish protocols for the structures/features that are expected to be negatively affected by the construction-related vibrations as shown in the monitoring plan.

5. Specifications for Proposed Vibration Monitoring Equipment
   a. Equipment for particle velocity shall be 3-channel (3 seismic channels) units capable of digitally storing collected data. Equipment shall be capable of printing ground motion time histories and summaries of peak motion intensities, frequencies and USBM R18507 PPV-frequency plots. Printed report records must also include date, time of recording, operator name, instrument number and date of last calibration. Other required system structures/features:
      i. Instruments shall have a flat frequency response between 2 and 250 Hz for particle velocity
      ii. The digitizing sampling rate for peak particle velocity measurements shall be at least 1,024 samples per second
      iii. Seismographs shall be capable of performing a self-test of velocity transducers and printed event records shall indicate whether or not the sensor test was successful.
      iv. Seismographs used for compliance monitoring shall be capable of recording particle velocity from 0.01 to 5.0 in/sec.
      v. Systems shall be capable of providing printed event reports that include all peak measurements, frequencies and complete waveform plots.
      vi. Seismographs shall have adequate memory to digitally record the entire duration of the construction-induced motion. The minimum event recording time shall be three seconds.
      vii. All seismograph software systems shall be capable of saving back-up copies of all event files on USB flash drives or portable hard drives, and copies shall be furnished to the OWNER.
      viii. The Contractor shall provide the seismograph reporting software to the OWNER with the first submittal of the vibration measurement records.

B. DURING CONSTRUCTION REQUIREMENTS:

1. Vibration Monitoring:
   a. Maintaining ground vibration within the limits imposed under this contract is critical to the success of this project. To assure satisfactory results for data acquisition, the collection of these data must be conducted under the supervision of a qualified vibration specialist or seismologist. The vibration specialist or seismologist shall be responsible only for monitoring and recording vibration. The vibration specialist or seismologist shall inform the
Contractor about monitoring results and may recommend modifications to the construction procedures; however, the Contractor shall be responsible for all construction decisions.

b. The vibration monitoring contractor and all persons performing monitoring work shall be an independent third party.

c. Vibrations shall be monitored at appropriate locations throughout the project. Vibration measured in peak particle velocity in inches per second shall be recorded at the monitoring locations. Monitoring locations shall be determined by the seismologist or other approved qualified vibration specialist within the guidelines in (2) below and approved by the OWNER. Each monitoring location shall be a secure, marked and surveyed position and shall remain at the same position. The Contractor may elect at the Contractor's expense to provide additional instrumentation at additional monitoring locations for any purpose.

d. Vibration monitors shall run continuously during the duration of the project's activities at the site, and readings on each seismograph shall be checked at the intervals recommended by the seismologist or other qualified vibration measurement specialist. If equipment allows, this data may be downloaded and checked remotely. See Section (2) for additional information.

e. The Contractor shall provide and maintain temporary weather protection as necessary for all measurement/monitoring facilities.

2. Vibration Control

a. The seismologist or other approved qualified vibration specialist shall place at least two (2) seismographs at structures/features of concern (or as recommended and approved by the OWNER) to measure and record ground movements during construction. The seismologist or other approved qualified vibration specialist shall provide qualified personnel capable of setting up instruments at designated locations to accurately record data, deploy the instruments, and operate, gather, and analyze the vibration data. The seismologist or other approved qualified vibration specialist shall use the collected data to control future construction vibration so as not to exceed the limits established in these specifications. The instrumentation shall record three orthogonal components (vertical, radial and transverse) of particle velocity direction. The PPV for compliance purposes is the highest measurement made in any of the three measured directions. The instrument records shall consist of instrument readings identified by instrument number; the location of instruments; the date, time and location of the measurements; and the peak particle velocity.

b. Construction activities shall be controlled in such a manner that the intensity of ground motion at the nearest existing structures/feature shall be limited to a peak particle velocity as set out in Section 1.3 (6) above or in accordance with Federal, State or local codes and regulations, whichever is more stringent.

3. Immediate Threshold Adherence
a. The OWNER shall be notified immediately when the intensity of measured ground motions (PPV) exceed specified warning levels. When the PPV threshold limit is exceeded one time or warning levels are exceeded more than three times at any type of structure/feature, the Contractor shall submit a revised construction plan to the OWNER that outlines specific measures that will be applied to bring ground motion levels into compliance within specified limits. The Contractor shall submit a printed copy of the monitoring records showing PPV values. A digital copy of the monitoring event records on a CD-ROM disk shall also be submitted.

4. Reporting
   a. The Contractor shall provide results of the testing to the Owner at the end of each workday when vibration inducing activities are conducted.
   b. The OWNER shall be notified of any movements detected and the Contractor shall immediately take any remedial measures required to prevent damage to the existing structures/features.

5. Damages:
   a. The Contractor shall make every effort to avoid damage to the existing utilities, appurtenances, levees, embankment or structures/features within the influence of any construction-induced vibrations including the use of site access routes.
   b. The Contractor is responsible for all construction related damages caused by, but not limited to, vibration or soil settlement from Project construction operations. Any damage caused by the Contractor's operations shall be repaired by the Contractor, to the satisfaction of the OWNER, at no additional cost to the Owner.
   c. Upon the discovery of any damage, construction operations shall cease until the Contractor has the damage repaired to the satisfaction of the OWNER or has agreed with the OWNER on an acceptable timeline by which the damage shall be satisfactorily repaired, and provides suitable measures to control future disturbance.
   d. The Contractor may consider stockpiling and performing laboratory tests in advance on materials that are to be used for any levee repairs.
   e. For repairs that are associated with the levee, excavation and stockpiling will not be permitted within 100 ft of the levee crest or 100 ft from inside the levee toe projection, whichever is less. Stockpiling of materials from inside the levee will not be permitted outside the levee.

C. POST-CONSTRUCTION REQUIREMENTS:

1. Post-Construction Survey
   a. Following the completion of the vibration producing activities, a post-construction condition survey shall be performed for each structure/feature that received a pre-construction condition survey. The pre-construction survey, photographs, video, descriptions and sketches shall be compared to the post-construction condition as described in the post-construction survey to
determine if any damage has occurred during the construction activities. The same individual or firm that performed the pre-construction survey shall perform the post-construction survey.

2. Vibration Monitoring Report
   a. A report will be prepared for each structure/feature previously identified with a summary that documents any changes from the pre-condition survey and whether any of the changes noted were a direct result of the construction activities. The qualified seismologist or other approved qualified vibration specialist shall attend the post-construction survey to provide input. Changes in the condition of any structure/feature impacted shall be documented with video, still photographs, and sketches and a detailed narration.

3. Site Restoration
   a. Any areas or items disturbed by the Contractor’s operations shall be restored to pre-construction conditions or replaced by the Contractor at no additional cost to the OWNER. The costs for any site restoration or replacement of items damaged as a result of the Contractor’s work shall be paid for by the contractor.

3.2 PROTECTION OF SITE

A. EXISTING STRUCTURES:

1. When the Plans require excavation, piling or other foundation construction operations in proximity to existing structures, the Contractor shall take precautions to prevent damage to such structures. The requirements described herein apply to all types of structures (within or outside of project limits) that may be adversely affected by construction operations (including phased construction) due to vibrations, ground loss, ground heave, levee slope movements or dewatering. The Contractor shall protect utilities as required.

2. When pile driving or excavating for construction, the Contractor is responsible for evaluating the need for, design of, and providing any necessary precautionary activities to protect adjacent structures/features from damage, including, but not limited to, selecting construction methods and procedures that will prevent damaging caving of the excavation and monitoring and controlling the vibrations from construction activities, including driving of piles, casings, and sheeting.

3. The Contractor shall survey and monitor structures for settlement in a manner approved by the Owner, recording elevations to 0.001 foot. The Contractor shall employ a qualified Specialty Engineer to inspect and document the condition of structures prior to and after completion of all pile installations, sheetpile installations, excavations and other related foundation construction activities, and to inspect and monitor the structures within the following influence zones as a minimum:
   a. As shown on the monitoring plans
   b. Within a distance of three times the depth of excavations
   c. Within 200 feet of pile installation and extraction operations
d. For pile driving operations, inspect and document the condition of all structures within a distance, in feet, of pile driving operations based on the recommendations of the seismologist or other approved qualified vibration specialist. Survey and monitor for settlement all structures within a distance, in feet, of pile driving operations based on the recommendations of the seismologist or other approved qualified vibration specialist.

4. The Contractor shall obtain the OWNER’S approval of the number and location of monitoring points and shall record survey elevations:
   a. Before beginning construction
   b. Daily during the driving of any casings, piling, or sheeting
   c. Weekly for two weeks after stopping pile driving
   d. During excavation
   e. Or as directed by the Engineer

5. The contractor shall notify the OWNER of any movements detected and immediately take any remedial measures required to prevent damage to the existing structures.

6. The OWNER will make the necessary arrangements to provide right of way entry to the existing structures.

B. CONCRETE:

1. The seismologist or other approved qualified vibration specialist shall provide vibration limits to ensure that concrete whose age is less than 7 days is not subjected to vibrations from pile driving, sheet pile driving and/or other construction activities located within 100 feet from the nearest outside edge of said concrete to the vibration source.

C. MISCELLANEOUS:

1. Upon detecting settlement, heave, or other slope movements, or vibration levels near threshold values, or damage to structures/features, immediately stop the source of vibrations or disturbance, backfill any open excavations, and contact the OWNER for instructions.

2. When shown in the Contract Documents or when authorized by the Engineer, the Contractor shall install the piling to the depth required to minimize the effects of vibrations or ground heave on adjacent structures/features by approved methods other than driving (preformed holes, predrilling, jetting, etc.).

3. When shown on the Plans or as directed by the Engineer, the Contractor shall install a piezometer near the property line and near any structure that may be affected by lowering of the ground water when dewatering is required. The Contractor shall monitor the piezometer and record the ground water elevation level daily, and notify the Engineer of any ground water lowering near the structure of 12 inches or more.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT
Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 05 12 00.00 Add – STRUCTURAL STEEL FRAMING

PART 1  GENERAL

1.1  SECTION INCLUDES
Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, equipment, appliances and materials, and performing all operations in connection with the performance of all work necessary to fabricate and erect all structural steel framing as described and specified herein and as shown on the Drawings.

1.2  RELATED SECTIONS
SECTION 01 22 10.00 Std – Measurement of Quantities
SECTION 09 96 56.01 Std – Epoxy Coatings – Coal Tar

1.3  REFERENCES
A. American Institute of Steel Construction (AISC):
   AISC 360: Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings
   AISC 303: Code of Standard Practice for Steel Buildings and Bridges

B. American Welding Society (AWS) Structural Welding Code
   Serial Designation D1.1: Specifications for Carbon Steel Electrodes

C. ASTM International Publications, latest editions:
   ASTM A-6: Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet piling
   ASTM A-53: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   ASTM A-108: Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
   ASTM A-153: Standard Specification for Zinc Coating (Hot-Dipped) on Iron and Steel Hardware
ASTM A-216  Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM A-490  Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

ASTM A-500  Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A-563  Standard Specification for Carbons and Alloy Steel Nuts

ASTM A-588  Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance

ASTM A-668  Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use

ASTM A-780  Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A-847  Standard Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance

ASTM A-992  Standard Specification for Structural Steel Shapes

ASTM B-695  Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM C-1107  Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

ASTM E-94  Standard Guide for Radiographic Examination

ASTM E-164  Standard Practice for Contact Ultrasonic Testing of Weldments

ASTM E-165  Standard Practice for Liquid Penetrant Examination for General Industry

ASTM E-709  Standard Guide for Magnetic Particle Testing

D. Steel Structural Painting Council (SSPC)

E. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs)

F. The Society for Protective Coating (SSPC) Surface Preparation Guides:
   1. SSPC-SP 2, “Hand Tool Cleaning”
   2. SSPC-SP 3, “Power Tool Cleaning”
   3. SSPC-SP 7/NACE No. 4, “Brush-Off Blast Cleaning”
   4. SSPC-SP 11, “Power Tool Cleaning to Bare Metal”
   5. SSPC-SP 14/NACE No. 8, “Industrial Blast Cleaning”
   6. SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning”
7. SSPC-SP 10/NACE No. 2, “Near-White Blast Cleaning”

8. SSPC-SP 5/NACE No. 1, “White Metal Blast Cleaning”

9. SSPC-SP 8, “Pickling”

G. International Accreditation Service (IAS) Accreditation Criteria AC472 – Inspection Programs for Manufacturers of Metal Building Systems

1.4 SUBMITTALS

A. Shop Drawings:

Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.

5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the professional engineer registered in the state of Texas responsible for their preparation.

B. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs):

Provide according to AWS D1.1, “Structural Steel Welding Code-Steel.” For each welded joint whether prequalified or qualified by testing, the power source (constant current or constant voltage).

C. Qualification Data:

For qualified installer, fabricator, professional engineer, and testing agency.

1. Fabricator Qualifications:

A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD. For metal building manufacturers, a manufacturer that participates in the accreditation program IAS AC 472.

2. Installer Qualifications:

A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE, or CSE as specified in the Special Provisions.
3. Shop-Painting Applicators:

Qualified according to AISC’s Sophisticated Paint Endorsement or SSPC-QP 3, “Standard Procedure for Evaluating Qualifications of Shop Painting Applicators.”

4. Welding Qualifications:

Qualify procedures and personnel according to AWS D1.1, “Structural Welding Code – Steel.”

The Chief Construction Manager, who is the Port Construction Representative as defined in Division 00- Procurement and Contracting Requirements, Section: Special Conditions, will limit the period of effectiveness of welders, welding operators, and tackers as set out below. These provisions shall supersede the provisions of corresponding sections of the Structural Welding Code cited heretofore.

Certificate of qualification submitted for a welder, welding operator or tacker in a fabricating shop, or manufacturing plant, will be accepted provided that such person has been tested by an approved testing laboratory within the preceding twelve months, and that the Operator has been doing satisfactory welding of the required type within the preceding three months.

If the quality of the work of any welder, welding operator or tacker is substandard, such person may be required to retake qualification tests.

5. Comply with applicable provisions of the following specifications and documents:

   a. AISC 303
   b. AISC 360

D. Welding Certificates

E. Paint Compatibility Certificates:

From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

F. Mill test reports for structural steel, including chemical and physical properties (two certified copies).

G. Product Test Reports for the Following:

1. Shear stud connectors.
2. Shop primers.
4. Other products as described in Special Provisions.

H. Source Quality-Control Reports

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off
ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer’s labels intact.

1. Fasteners may be repackaged provided PHA’s testing and inspecting agency observes repackaging and seals containers.
2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers’ written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Plate and Bar: ASTM A 572 GR50

B. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588, GRADE 50 (345)

C. Steel Pipe: ASTM A 572 Grade 50

1. Weight Class: As specified or shown on drawings.
2. Finish: As specified or shown on drawings.

D. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: Fabricator’s standard lead and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI #79 and compatible with topcoat

B. Galvanizing Repair Paint: MPI #18, MPI #19, OR SSPC-Paint 20, ASTM A 780

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout:

ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 FABRICATION

A. Structural Steel:

Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC’s “Code of Standard Practice for Steel Buildings and Bridges” and AISC 360.
1. Camber structural-steel members where indicated.

2. Fabricate beams with rolling camber up.

3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.

4. Mark and match-mark materials for field assembly.

5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operation.

B. Thermal Cutting:

Perform thermal cutting by machine to greatest extent possible.

Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes:

Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing:

Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning:

Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP1, “Solvent Cleaning.

F. Shear Connectors:

Prepare steel surfaces as recommended by the manufacturer of shear connectors. Use automatic and welding of headed-stud shear connectors according to AWS D1.1 and manufacturer’s written instructions.

G. Holes:

Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Baseplate Holes:

Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
2.5 SHOP CONNECTIONS

A. Weld Connections:

Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

In all lapped or “Tee” splices or other joints using intermittent fillet welds, the edges of faying surfaces shall be continuously seal welded in addition to the required strength weld.

2.6 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).

2. Surfaces to be field welded.

3. Surfaces to be high-strength bolted with slip-critical connections.

4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).

5. Galvanized surfaces.

B. Surface Preparation:

Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, “Hand Tool Cleaning”.

2. SSPC-SP 3, “Power Tool Cleaning”.

3. SSPC-SP 7/NACE No. 4, “Brush-Off Blast Cleaning”.

4. SSPC-SP 11, “Power Tool Cleaning to Bare Metal”.

5. SSPC-SP 14/NACE No. 8, “Industrial Blast Cleaning”.

6. SSPC-SP 6/NACE No. 3, “Commercial Blast Cleaning”.

7. SSPC-SP 10/NACE No. 2, “Near-White Blast Cleaning”.

8. SSPC-SP 5/NACE No. 1, “White Metal Blast Cleaning”.

9. SSPC-SP 8, “Pickling”.

C. Priming:

Immediately after surface preparation, apply primer according to manufacturer’s written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.7 PERFORMANCE REQUIREMENTS

A. Connections:

Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated in the Drawings.

1. Select and complete connections using schematic details indicated and AISC 360.

2. Use LRFD: data are given at factored-load level or ASD: data are given at service-load level as directed in Special Provisions or on the Drawings.

B. Moment Connections:

Type PR, partially, or FR, fully restrained, as directed in Special Provisions or on the Drawings.

C. Construction:

Moment frame, braced frame, shear wall system, combined system of moment frame and braced frame, combined system of moment frame and shear walls, combined system of braced frame and shear walls, combined system of moment frame, braced frame, and shear walls as directed on the Drawings.

2.8 GALVANIZING

For steel components specified to have Hot-Dip Galvanized Finish:

Apply zinc coating by the hot-dip process to steel according to ASTM A 123.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency:

PHA will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in work that test reports and inspections indicate does not comply with the
Contract Documents.

C. Welded Connections:

In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164
4. Radiographic Inspection: ASTM E 94
   Test 100% of Complete Joint Penetration (CJP) welds using ultrasonic or radiographic inspection. Randomly inspect 50% of all Partial Joint Penetration (PJP) welds and fillet welds or as indicated by magnetic particle or liquid penetrant inspection.

D. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers’ recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

3.2 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment for compliance with requirements.

Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

Provide temporary shores, guys, braces, and other supports during erection to keep structural steel...
secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.4 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 AND AISC 360.

B. Base Bearing and Leveling Plates:

Clean concrete surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Tighten as specified anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer’s written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC’s “Code of Standard Practice for Steel Buildings and Bridges.”

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by PHA. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors:
Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer’s written instructions.
3.5 FIELD CONNECTIONS

A. Weld Connections:

Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC’s “Code of Standard Practice for Steel Buildings and Bridges” for mill material.

3.6 FIELD QUALITY CONTROL

A. Testing Agency:

Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Welded Connections:

Field welds will be visually inspected according to AWS D1.1/D1.1M.

In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency’s option:

1. Liquid Penetrant Inspection: ASTM E 165

2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3. Ultrasonic Inspection: ASTM E 164

4. Radiographic Inspection: ASTM E 94

Test 100% of Complete Joint Penetration (CJP) welds using ultrasonic or radiographic inspection. Randomly inspect 50% of all Partial Joint Penetration (PJP) welds and fillet welds or as indicated by magnetic particle or liquid penetrant inspection.

C. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
D. Correct deficiencies in work that test reports and inspections indicate does not comply with the Contract Documents.

3.7 REPAIRS AND PROTECTION

A. Galvanized Surfaces:

Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touch-Up Painting:

Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touch-Up Painting:

Cleaning and touch-up painting are specified in Division 09 Sections.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 09 96 56.01 Add - EPOXY COATINGS – COAL TAR

PART 1  GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing and the application of a two-component polyamide coal tar epoxy coating to steel surfaces as described and specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities
SECTION 05 12 00.00 Std – Structural Steel Framing

1.3 REFERENCES

A. National Association of Corrosion Engineers
   SP0188-2006-SG Discontinuity (Holiday) Testing of New Protective Coatings on Conducive Substrates

B. The Society for Protective Coatings (SSPC) Publications, latest edition:
   SSPC 16 Coal Tar Epoxy Polyamide Black (or Dark Red) Coating
   SSPC SP-10 Near White Blast Cleaning
   SSPC Vis-1 Guide and Reference Photographs for steel Surfaces Prepared by dry Abrasive Blast Cleaning

1.4 SUBMITTALS

A. Product Data for: Coatings with certified affidavit attesting SSPC Paint No.16.

1.5 HANDLING AND STORAGE

A. All material shall be delivered to the point of application in unopened factory containers with labels intact and shall be accompanied by the manufacturer's instruction for use. Any material found to not comply with these Specifications shall be removed from the job site immediately after notification by the Chief Construction Manager. The Chief Construction Manager is the Port Construction Representative of the Port of Houston.

B. All coating materials shall be stored as required to protect them from the weather. Exposure to heat or cold in excess of that recommended by the manufacturer shall be cause for rejection. The coating shall be stored in areas complying with City, County, State and Federal safety codes for flammable materials.
PART 2 PRODUCTS

2.1 MATERIAL

A. Color shall be black unless red is approved by the Chief Construction Manager.

B. The coating shall consist of a two-component polyamide cured coal tar epoxy conforming to The Society of Protective Coatings Specification No. 16 – latest ed., formulated with Type 1 coal tar pitch. The coating manufacturer shall furnish a certified affidavit attesting that his products conforms to SSPC Paint No. 16 – latest ed., specifications. The Inspector reserves the right to take samples and perform tests as required to establish the quality of the coating materials (see Paragraph titled "Material Testing" of the General Conditions). The sample shall be a complete unopened kit selected at random and furnished at the Contractor's expense.

PART 3 EXECUTION

3.1 GENERAL

The manufacturer shall furnish the services of one of his representatives who is fully conversant with the application of the material and who shall be on call while coating is applied to advise the Contractor and the Chief Construction Manager concerning the preparation of surfaces and the application of coating.

3.2 SURFACE PREPARATION:

All surfaces to be coated shall be solvent cleaned to remove all grease, dirt or wax and shall be blast-cleaned in accordance with the Society for Protective Coatings Specification SP-10 – latest ed., (near-white blast). All rust, burrs, mill scale and welding slag and splatter shall be removed. Sharp irregular protuberances of weld metal and irregular edges and burrs on flame-out or sheared pieces shall be ground smooth. Blast cleaning shall extend six inches beyond the area to be coated and shall be continuous on the entire circumference or perimeter of the member. The type and size of abrasive shall be selected to obtain a profile depth of 1.5 mils minimum. The abrasive for blast cleaning shall be grit or a mixture of grit with not more than fifteen percent of steel shot. If used grit is reclaimed, all makeup shall consist entirely of grit. The air supply system for blast cleaning shall be provided with means for removing all entrained moisture before air reaches the nozzle.

All work blast cleaned in any day shall be coated the same day before the atmospheric temperature drops to within 5 degrees above the dew point. Any blast-cleaned areas not coated on the same day as cleaned shall be whip-blast cleaned to remove rust bloom. All surfaces shall be completely free of moisture, dirt, sand, grit, oil, grease, or other contaminants at the time coating is applied. Oil or grease smudges shall be removed by cleaning with a solvent complying with the coating manufacturer's recommendation.

Blast cleaning of each piece to be coated shall be inspected and approved by the Chief Construction Manager before any coating is applied. The coating contractor shall schedule his work and notify the Chief Construction Manager in adequate time so that arrangements can be made for inspection. Safe access to all areas to be inspected, shall be provided by the Contractor.

All cleaning shall be performed so that dust or other contaminants do not fall on uncured painted surfaces. Surfaces not to be painted shall be suitably protected from the effects of cleaning or painting operations.
3.3 MIXING OF COATING

The two components shall be mixed strictly in accordance with the manufacturer's instructions and only in quantities that will be used within the mixed materials pot-life. No additives shall be used to extend the pot-life except as may be specifically set out in the manufacturer's instructions. Mixed materials not used within the pot-life shall be discarded. No thinner shall be used without prior approval by the Chief Construction Manager. Thinner, if used, shall be that specified by the manufacturer of the coating. Except when specifically waived in writing by the PHA Chief Construction Manager, all mixing shall be done in the presence of the Chief Construction Manager.

3.4 AIRLESS SPRAY EQUIPMENT

The coating shall be applied with the “airless spray” method using Grayco or equal airless spray equipment which has a minimum ratio of fluid pressure to air pressure of 30:1. Hose shall be aromatic solvent resistant nylon or “Teflon”. Tips shall be selected to produce a uniform coating of the thickness required by these specifications, free of pinholes, and without running, curtaining or sagging.

Equipment shall be completely clean and free of any other coating material and shall be thoroughly cleaned after each use, using a solvent that will remove the specified coating from the equipment. When resuming operations, sufficient coating materials shall be pumped through the system so that any residual solvent will be completely removed before applying coating.

3.5 APPLICATION OF COATING

The surfaces to be coated shall be sandblasted, dry and free of dust, burrs, grit, sand, dirt, rust, mill scale, welding slag, splatter, oil, grease, or other contaminants at the time coating is applied. No coating shall be applied when the air temperature is under 50 degrees F. or when the temperature is less than 5 degrees F. above the dew point.

The coal tar-epoxy shall be applied in a minimum of two uniform coats of eight to ten mil dry film thicknesses to produce not less than a total of 16 mils (0.016 inch) or more than 20 mils of dry film thickness for the system.

All areas not easily accessible by spray equipment such as sharp edges, interlocks, drilled holes, welds, cracks, crevices, rivets, bolts and nuts, may be pre-coated by brush or other suitable means approved by the Chief Construction Manager.

Where feasible, the entire area shall be coated as one continuous operation applying the first coat and following with the second coat approximately one hour later. In the case of steel sheet piling, steel bearing piles and steel pipe piles that are to receive welded attachments or joints after being driven, coating shall be interrupted for at least one foot each way from such welding or at least two feet from any flame cutting that may be required. The skipped areas shall be coated as a second phase. The edge of the first phase coating shall be feather-edged for at least one foot. Just prior to applying the second phase of coating, the first phase shall be lightly blasted, lightly sanded or hand-wire brushed to produce a tooth and shall be wiped generously with methyl isobutyl ketone (MIBK).

3.6 APPEARANCE

The finished coating shall be smooth, glossy, free of sharp protuberances, and shall be free of pin holes. Minor sags, dimpling or curtaining that does not exceed two percent of the entire surface of a pile or other element, will be allowed provided they do not present sharp edges. Protuberances and sharp edges shall be cut off carefully with sharp wood chisel laid flat against the surface. The zones from which excess has been removed shall be sanded or hand wire-brushed, lightly wiped with MIBK and re-coated to a smooth surface.
3.7 INSPECTION

Only after the Contractor has made his own thorough inspection and is satisfied that he has performed the work in accordance with the specifications, shall he request an inspection.

Surface preparation of each piece of material to be coated shall be inspected and approved by the Chief Construction Manager prior to the application of coating. The quality of surface preparation will be determined by comparison with Pictorial Surfaces Preparation Standards for Painting Steel Surfaces (The Society for Protective Coatings Designation SSPC-Vis-1). Inspection for thickness and coating will be by means of a magnetic dry film thickness gauge; and inspection for pinholes and holidays will be made with non-destructive electrical equipment.

All areas having insufficient thickness of coating shall be recoated to the required thickness, and all areas containing pinholes shall be over-coated sufficiently to close these imperfections. When more than five such areas are found on any one piece, the Chief Construction Manager may require the entire piece to be over-coated.

All areas to be over-coated shall be lightly blasted or hand-wire brushed lightly and wiped with MIBK before applying additional material. Hand wire brushing will only be permitted in the first 48 hours after application.

3.8 HANDLING OF COATED MATERIAL

Coated material shall be handled carefully with slings that will not mar the coating. All areas marred in handling, shipping, erecting, welding or pile-driving shall be recoated as soon as possible after they are discovered, using the techniques set out in this specification.

Coated pieces shall be shipped and stored with padded dunnage separating pieces and with pads under tie down chains or straps. Coated material shall not be stacked more than 42" high, except that pipe more than 20" in diameter and structural shapes more than 20" in depth may be stacked in two layers with padded dunnage between layers.

No markings shall be made on members with lead-based paints, grease crayon or other material incompatible with the coating. If marking is necessary, coal tar enamel or stamp markings shall be used.

Surfaces coated with coal tar-epoxy shall not be immersed in water until the coating has cured for at least 72 hours. Piling coated with coal tar epoxy shall not be driven until the coating has cured for at least seven days.

3.9 COATING CONTAMINATION

The Contractor is cautioned that the location designated on the drawings as the pile coating area may be subject to blowing dust by construction activity. He shall, therefore, take precautions to prevent contamination of the coating. Contaminated coating shall be cause for rejection and shall be removed and recoated at no cost to the Port Houston.

3.10 DAMAGE AVOIDANCE PRECAUTIONS

The Contractor shall take all precautions to control overspray and shall be liable for all damage incurred.

END OF SECTION
PORT OF HOUSTON AUTHORITY
TECHNICAL SPECIFICATIONS

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 31 23 00.00 Add – EXCAVATION AND FILL

PART 1 - GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; all clearing and grubbing and all excavating, filling, backfilling, grading and compacting of soils for temporary construction access, interim access roads, preparation of subgrade, site restoration and for preparation of other soil areas as described and specified herein and as shown on the Drawings.

Drilled shafts, lime or cement stabilization of subgrade, cement stabilized sand fill, flowable fill, and trenching and backfill for sewers, water lines and other underground utilities, clearing and grubbing, topsoil, hydro mulching and sodding are not included in this Section.

Site work shall include the excavation, loading, hauling, dumping and spreading of soil; undercutting to remove unstable or unsuitable soil; compacting existing soil surfaces, and bottom of excavated areas to receive fills and backfills; compaction of excavated areas for subgrade; placing and compacting soil in fills and backfills; pumping to keep excavated areas dry; finish grading for subgrades final grades; disposing of unsuitable and excess excavated material; and all work incidental to such work, all as shown on the Drawings and specified herein.

1.2 RELATED SECTIONS

1.3 REFERENCES

A. ASTM International Publications, latest editions:

ASTM D-422 Standard Test Method for Particle Size Analysis of Soils

ASTM D-698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))

ASTM D-1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft lbf/ft³ (2,700 kN m/m³))

ASTM D-2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)


ASTM D 6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
1.4 SUBMITTALS

A. Test Data for Fill Material: Proctor, Atterberg Limits, Gradation, Soil Classification.

B. Topographic Surveys: Topographic surveys before and after construction, with calculations, to establish final quantities for payment, in the medium or software designated in the contract documents.

C. Borrow Sources: Location, extent, quantity and planned depth of each on-site borrow source. For off-site borrow sources, submit site name, location, and contact information.

D. Where shoring is required due to depth of excavation: Shoring Plan, certified by a Texas registered professional engineer, describing the methods for shoring of excavations.

E. Where water levels will impact excavation operations: Dewatering Plan.

1.5 HANDLING AND STORAGE

Refer to the General Conditions.

PART 2 - PRODUCTS

2.1 COMMON FILL

Common fill for areas that do not require compaction 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. Fill may be obtained from the areas indicated on the plans or from borrow sources approved by the Chief Construction Manager.

2.2 COMPACTED IMPERVIOUS FILL

Perimeter berms, including any backfill required beneath berm foundation areas, shall be constructed with fill materials consisting of soil classified as CL, CH, or SC obtained from borrow areas designated on the drawings or approved by Engineer. Borrow areas for impervious fill materials (CL, CH or SC) shall be located/identified and tested by Contractor and approved by Engineer. Perimeter Berm Materials shall meet the following requirements:

A. Maximum particle size: 2 inches when tested in accordance with ASTM D6913.

B. Minimum percent passing No. 200 Sieve: 30% when tested in accordance with ASTM D1140.

C. Minimum Plasticity Index: 15 when tested in accordance with ASTM D4318.

2.3 COMPACTED FILL OR BACKFILL

Compacted fill or backfill material should be free of soils classified as GW, GP, SW or SP, 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 and shall have the following plasticity range:

Plasticity Index - Between 25 and 35(unmodified) (ASTM D-4318)
2.4 UNSUITABLE MATERIALS
Materials such as rubbish, brush, organic material, timber and metal debris, roots over ½-inch in diameter, rope, plastic, and rocks larger than 6 inches in diameter shall be considered Unsuitable Materials and not be placed as fill.

2.5 TOPSOIL
Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 1”, brush, weeds, toxic substances, and other material detrimental to plant growth.

PART 3 - EXECUTION

3.1 USE AND MAINTENANCE OF ROADS

The Contractor shall conduct its grading and hauling operations in an orderly and safe manner, and shall protect the traveling public, the operations of the Port 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 Law. On the property of the Port Authority, the Contractor's hauling operations shall not interfere with the normal operations of the Port Authority's port facilities or with truck and rail traffic to and from such facilities.

The Contractor shall maintain dirt surfaced haul roads used by it and leave them in a condition acceptable to the Chief Construction Manager upon completion of their use. Flexible base surfaced and paved roads used by the Contractor shall be repaired by the Contractor at its expense wherever damaged by Contractor's operations, and Contractor shall restore such roads to the condition existing prior to such damage.

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 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.

3.2 CROSSING FENCES

In the event fences must be crossed by the Contractor, such fences shall be opened only as directed by the Chief Construction Manager and be kept closed between passage of traffic except as permitted by the Chief Construction Manager. Upon completion of the work, the fences shall be repaired to their condition existing prior to the beginning of the Contractor's work.

3.3 STRIPPING

Strip suitable topsoil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be stockpiled or disposed as approved by the Chief Construction Manager.

3.4 EXCAVATION

Excavation is defined as the removal of earth, loose rock, gravel, shell, and 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 and the excavation of drainage ditches, side slopes of cuts, and shoulder areas.

All excavation will be unclassified as to type.
Only Suitable Materials shall be used in making fills and backfills, as required, within the limits of the project. Materials such as rubbish, brush, organic material, timber and metal debris, roots over ½-inch in diameter, rope, plastic, and rocks larger than 6 inches in diameter shall be considered Unsuitable Materials and not be placed as fill. Suitable materials include common fill, impervious fill, compacted fill and topsoil.

The Contractor shall remove from all 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 Chief Construction Manager and refill the space with acceptable material. Backfill material shall be placed in accordance with the requirements for compacted fills and backfills. In areas where the berms will be raised atop existing dredge material, reference Technical Specification 31 24 00 Embankment Construction.

If the Contractor for any reason fails to comply with its Standard of Care in excavating and preparing rough grade for compaction and there is a deficiency of earth after compacting of finish subgrade surfaces, then Contractor shall fill such low areas and compact as directed by Chief Construction Manager without extra compensation.

Excavations shall be made to the cross sections, lines and elevations shown on the Drawings.

3.5 DRAINAGE AND DEWATERING

Provide for the collection and disposal of surface and subsurface water encountered during construction.

A. Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish storm drainage to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales, pumps, and other drainage features and equipment as required to maintain dry soils. It is the responsibility of the Contractor to assess the soil and ground water conditions prior to excavation or fill, and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and any other area affecting operations at the site shall be continually and effectively drained.

B. Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of the work. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure.

3.6 COMPACTION OF NATURAL GROUND AND SUBGRADE

A. Compaction Requirements:

Compaction requirements for natural ground and subgrades beneath embankments for perimeter berms and interior berms shall comply with 31 24 00 Embankment Construction.

All other natural ground and excavated areas which are to receive compacted fill shall be compacted to a depth of six inches (6”). The top six inches (6”) 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 percent of maximum laboratory dry density as determined in accordance with ASTM D-698 (Standard
3.7 CONSTRUCTION OF COMPACTED FILLS AND BACKFILLS

The hauling, placing and compaction of excavated material for earth embankments shall comply with 31 24 00 – Embankment Construction.

All other subgrades, fills or backfills shall be performed in accordance with the following requirements:

Only compacted fill, as defined herein, shall be used in making compacted fills and backfills, as required, within the limits of the project.

Unsuitable Material include materials such as rubbish, brush, organic material, timber and metal debris, roots over ½-inch in diameter, rope, plastic, and rocks larger than 6 inches in diameter shall be considered Unsuitable Materials and are not be placed as compacted fill.

If ground water or natural ground conditions warrant, at the discretion of the Chief Construction Manager, the following techniques may be used to “bridge” the existing material. Semi-compact fill or backfill may be placed from the bottom of the excavation to one foot above the elevation of ground water. Fill or 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.

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, in maximum lifts of 1-foot each (loose measurement). If it is demonstrated that required density is not being achieved throughout the depth of the compacted lift, the maximum allowable loose lift may be reduced to 8-inches. Each layer shall extend across an entire fill or backfill section. Each layer shall be wetted or dried to produce optimum moisture content, and compacted to a density of:

1. For subgrade and embankment under proposed pavement or structures, not less than ninety-five percent (95%) of maximum density at +/-3 percent of optimum moisture in accordance with ASTM D-698 (Standard Proctor), including the top layer.

2. For backfill and fill areas outside the limit of proposed pavement compacted to a minimum density of ninety-five percent (95%) of maximum density at +/-3 percent of optimum moisture in accordance with ASTM D 698 (Standard Proctor).

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 Chief Construction Manager may require a soil test 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.

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 Chief Construction Manager, 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.
After the compaction of each layer of soil is completed, density tests can be requested by Chief Construction Manager. 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 Chief Construction Manager, the Contractor may alter his compaction method on subsequent work to obtain the specified density.

Compacted strips that are to be left temporarily or overnight may be partially sealed by rolling with pneumatic tire or smooth drum roller to reduce the loss or gain of moisture.

Contractor shall blade-off areas for compaction testing, as requested by the Chief Construction Manager.

3.8 FINISH GRADING

Compacted subgrades and the top surfaces of fills and backfills in areas specified shall be sealed with a pneumatic or smooth drum roller and finished to a smooth surface with a grader blade to the line and grade required.

All grading shall conform to the location, size and elevations shown on the Drawings. No equipment or hauling shall be permitted on finished subgrades unless approved by the Chief Construction Manager. Any damage caused to such portions of the subgrade by the operations of the Contractor shall be repaired by Contractor at the Contractor’s expense.

Should the subgrade, for any reason or cause, lose the required stability, density or finish it shall be recompacted and refinished at the expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling and/or sealing.

3.9 DITCHES AND SLOPES

Drainage ditches, including the bottom and side slopes thereof 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 acceptable material 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.

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 insure compaction of the entire fill.

3.10 DISPOSAL OF EXCESS MATERIALS

Unless otherwise provided in these Technical Specifications, all unstable excavated materials and all excess unsuitable earthen materials, trash, and debris shall become the property of the Contractor and shall be removed and disposed from the project at the Contractor's expense as per requirements stated in the General Conditions.

3.11 PROTECTION OF EXISTING STRUCTURES

The Contractor will be held responsible for any damage to manholes, inlets, valves, pipes, or other facilities that are caused by him in making the necessary excavation and fills. The Contractor shall repair all such damage at Contractor’s expense.
3.14 PROOF ROLLING

The Contractor shall proof roll earthwork, base or subbase using pneumatic tire rollers, dump trucks or other compaction equipment provided in these Technical Specifications or approved by the Chief Construction Manager. Use equipment that when loaded weighs at least 10 tons. The maximum acceptable load is 50 tons. Material that exhibits rutting or pumping shall be undercut and replaced, at Contractor’s expense.

3.15 UTILITIES

The Contractor shall be responsible for identifying and locating utilities in the vicinity of the excavation. Contractor shall be responsible for obtaining permits and/or approvals from utility owners to cross and/or excavate or fill in or around utilities or utility rights-of-way. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor’s risk.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 31 24 00 Add – EMBANKMENT CONSTRUCTION

PART 1 – GENERAL

1.01 SUMMARY

The work covered in this Section consists of furnishing labor, equipment, and other incidentals necessary to perform the construction, relocation, and repair of perimeter and stability berms with excavated materials at Placement Areas (PAs), and for other earthwork incidental to the PA berm construction. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown on the plans.

1.02 RELATED SECTIONS

Section 01 71 23.16 – Construction Surveying

Section 31 23 00.00 - Excavation and Fill

1.03 REFERENCES

The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

A. American Society for Testing Materials (ASTM) Publications

<table>
<thead>
<tr>
<th>ASTM Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>D698 (2012)</td>
<td>Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu ft (600 kN-m/cu. m.))</td>
</tr>
<tr>
<td>D1556 (2015)</td>
<td>Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method</td>
</tr>
<tr>
<td>D2216 (2010)</td>
<td>Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass</td>
</tr>
<tr>
<td>D2487 (2017)</td>
<td>Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)</td>
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ASTM D6938 (2017) Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM D7928 (2017) Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

U.S. ARMY CORPS OF ENGINEERS (USACE)


ER 1110-1-261 (1999) Quality Assurance of Laboratory Testing Procedures

1.04 SUBMITTALS

Engineer’s approval is required for submittals with an “E” designation; submittals not having an “E” designation are for information only. The following shall be submitted in accordance with Section 01 33 00, “Submittal Procedures”: 

A. Work Plan: At least 21 days prior to commencement of site work, submit a Work Plan for review by Engineer. Work Plan shall outline Contractor’s approach for accomplishing the berm construction, for the location and construction of any temporary haul roads, temporary construction roads, staging areas, storage areas (as applicable), and for dewatering borrow areas and any other excavations. This Plan shall include, but not be limited to, the following:

1. Planned sequence of construction for berms, and shoreline protection, as applicable. Include excavation of borrow areas and berm foundation areas. Include plan and cross-sectional schematic drawings showing starting and final work locations and clearing, grubbing and stripping limits.

2. Show locations of planned ingress/egress routes and any temporary facilities as well as provisions taken to minimize access issues and work delays caused by inclement weather.

3. Methods and types of equipment to be utilized for excavation, handling, placing, and compaction.

4. Plan for locating/identifying and testing borrow areas within the PAs.

5. Planned erosion control measures and other environmental controls, including work exclusion areas.


7. Material distribution and stockpiling plan.

8. Trenching and shoring plan, as applicable.
9. Planned methods for dewatering including control of surface and ground water in the borrow areas and any other excavations. Describe equipment types and planned durations.

B. Planned methods for demobilization and site control, including measures to address flooding, if an extreme coastal storm impacts the work area. Refer to Site storm protection requirements in TBD.

C. If necessary, modify the Plan as required to meet field conditions; any modifications to the plan will require an additional submittal to Engineer for review.

D. Submit geotechnical engineer report showing placement of fill or excavation associated with the Work Plan (outside of the placement of fill and excavation shown on the contract Plans) will meet US Army Corps of Engineers required factors of safety for stability.

E. **Daily Activities Reports:** Refer to General Specifications for daily reporting requirements.

F. **Borrow Material Testing:** Regular testing is required to verify suitability of the borrow material placed for berm construction (see Section 1.05 – Quality Assurance).

### 1.05 QUALITY ASSURANCE

A. **Excavation:** Establish and maintain quality control for excavation operations to assure compliance with Contract requirements, and maintain records of the quality control for construction operations including the following:

1. Lines, grades and tolerances.
2. Disposition or stockpiling of materials, including any Unsuitable Materials.
3. Conditions that may induce seepage or weaken the foundation of berms.
5. Drainage condition of the borrow areas and any associated dewatering performed.

B. **Berms:** Establish and maintain field quality control for foundation preparation and berm construction operations to assure compliance with Contract requirements. Contractor's quality control shall include the following:

1. Foundation Preparation: Document work performed to prepare foundations in advance of berm construction, and methods for providing drainage or dewatering of the foundation and partially completed fills.

2. Borrow material for construction of perimeter berm(s) shall be tested for compliance with the requirements for Perimeter Berm Materials as stated in Paragraph 2.02.C, Testing documentation and results shall be submitted weekly with Contractor's Daily Reports (Paragraph 1.04.B). At a minimum, testing frequency shall be as follows:

   a. Gradation Tests (ASTM D6913 and D1140): One test per 10,000 cubic yards or per change in material.

   b. Moisture-Density Relationship Tests (ASTM D698): One test per 10,000 cubic yards or per change in material.
c. Atterberg Limits (ASTM D4318): One test per 10,000 cubic yards or per change in material.

d. "Change in material" shall be determined by Contractor's geotechnical testing agency based on changes in location of material source, or readily observable changes in material type, color, plasticity, and/or grain size distribution.

3. Layout, drainage control, moisture control, thickness of layers, removal of oversized material, and spreading and compaction for perimeter berms shall be documented.

4. Perform in-place moisture/density testing for cohesive materials placed for construction of perimeter berm(s). The in-place moisture/density tests of the cohesive materials shall be determined and reported in accordance with ASTM D1556 or ASTM D6938. At least one in-place moisture/density test shall be performed at a frequency of 1 test per 5,000 sq. ft of each compacted lift (8 inches maximum). Nuclear density testing equipment shall not be used during rain.

C. Construction Surveys: Perform surveys to verify that the dimensions, slopes, lines, and grades conform to specified requirements. Refer to specification Section 01 71 23.16, Construction Surveying, for survey requirements.

D. Testing by Engineer: During the life of this Contract, Engineer may perform independent quality assurance tests. Contractor shall make the equipment needed to perform these tests available to Engineer.

E. Testing Agencies: Laboratories performing Contractor's tests shall be accredited in accordance with ASTM D3740. Personnel engaged in the testing shall be certified in accordance with ASTM D5255. Engineer or Engineer's designated representative shall be provided advance notification of field sampling and testing so that he/she may observe the sampling/testing.

F. Records: A copy of the records of inspections and corrective actions taken shall be included in the daily quality control reports.

1.06 DEFINITIONS

Berm and Embankment: The terms "Embankment" and "Berm" are interchangeable in these specifications and drawings. "Embankment" and "Berm" are defined as the earth fill portions of the berm system, or other fills related to a berm construction, including interior berms, stability berms, and perimeter berms.

1.07 SITE CONDITIONS

A. Surface Drainage: Contractor shall be aware that the project site is subject to ponding during and after rain and high tide events. Surface water shall be directed away from excavations and construction sites to prevent erosion and undermining of foundations. Diversion ditches and grading shall be provided and maintained as necessary during construction. Ponding water and undrained water in the excavation areas in the PAs shall be drained through pumps or other approved available methods. Newly constructed slopes and backfill surfaces shall be protected to prevent slope surface erosion and sloughing. Excavation shall be performed so that the excavated areas and surrounding areas are drained continuously and effectively.

B. Changes in Berm Alignment: The right is reserved by Engineer to make changes in the berm alignments as may be found necessary before completion of the work. If it becomes
necessary, through no fault of Contractor, to abandon a line or location on which work has been done, payment for materials placed will be made as specified in the associated payment item.

C. Subsurface Soil Information: Geotechnical investigation data is provided in Appendix A. This data represents the most recent information available. Variations may exist in the soil conditions between sample locations. In addition, groundwater levels indicated on the soil boring logs were levels found at the time of exploration. The groundwater level in the PAs can vary significantly depending on time of year, the amount precipitation, and tides. Contractor shall also be aware that debris is likely to be encountered during excavation. Contractor shall draw his own conclusions as to the character of the in-situ soil materials, groundwater levels, and amount and type of debris that may be encountered.

D. Stockpiling: When the excavation from designated borrow sources progresses at a faster rate than placement in the fill is being accomplished, such excavated material shall be stockpiled at approved locations adjacent to the work until its use. No separate payment will be made for such stockpiling nor for the loading and hauling of this material to its final position.

E. Construction Access Roads: Access roads shall be constructed to facilitate transportation of equipment and materials to the construction areas as necessary and shall be located within approved limits. Access roads shall be constructed to accommodate the intended loads and frequency and be maintained in well-drained and functional condition during the Contract period. Access roads shall be planned so as not to pond water or otherwise impede site drainage and shall be maintained during the Contract period to provide required drainage as described herein. Site access roads are to remain passable at all times to minimize construction delays due to inclement weather. The costs associated with construction of access roads shall be considered a subsidiary obligation of the Contractor.

PART 2 – PRODUCTS

2.01 GENERAL

Materials for embankment fills shall be secured from required excavations as indicated on the Drawings. The intention is to use the most suitable materials obtainable from these sources. Material to be wasted will be specifically designated by Contractor at the time the material is excavated. Materials containing brush, roots, sod or other perishable or organic materials shall not be considered suitable for berm construction. Available soil profiles are provided in Appendix B for borrow excavation references; however, the soil materials may vary from the sampled locations. Actual suitability of the materials shall be subject to testing by Contractor, and to field review by Engineer.

2.02 FILL MATERIALS

A. Location: Fill materials shall be obtained from borrow area locations within the PA as identified and tested by Contractor and approved by Engineer. All fill material shall be subject to testing by Contractor prior to placement for perimeter berm construction.

B. Soil Classification: Materials shall be classified in accordance with ASTM D2487 (Unified Soil Classification System).
C. Suitable Materials:

1. Perimeter Berm Material: Perimeter Berm materials shall consist of impervious fill as defined herein and in Technical Specification 31 23 00.00 Excavation and Fill. Perimeter berms, including any backfill required beneath berm foundation areas, shall be constructed with fill materials consisting of soil classified as CL, CH, or SC obtained from borrow areas designated on the drawings or approved by Engineer. Borrow areas for impervious fill materials (CL, CH or SC) shall be located/identified and tested by Contractor and approved by Engineer. Perimeter Berm Materials shall meet the following requirements:

   a. Maximum particle size: 2 inches when tested in accordance with ASTM D6913.

   b. Minimum percent passing No. 200 Sieve: 30% when tested in accordance with ASTM D1140.

   c. Minimum Plasticity Index: 15 when tested in accordance with ASTM D4318.

2. Interior Berm Material: Interior berm material may be constructed with Common Fill material consisting of generally any type of soil listed in Paragraph 2.01.B, per Technical Specification 31 23 00.00 Excavation and Fill.

D. Unsuitable Materials: Materials such as rubbish, brush, organic material, timber and metal debris, roots over ½-inch in diameter, rope, plastic, and rocks larger than 6 inches in diameter shall be considered Unsuitable Materials and not be placed as fill. These materials will be placed in designated areas on the interior of the PA.

PART 3 – EXECUTION

3.01 GENERAL

A. Lines and Grades: The berms shall be constructed to the lines, grades, and cross sections indicated on the Drawings. Engineer reserves the right to increase or decrease the foundation widths and berm slopes, or to make other changes in the berm or berm sections, as may be considered necessary to produce a safe and functional earthen structure.

B. Conduct of the Work: Contractor shall maintain and protect the newly constructed and/or improved berms in a satisfactory condition during construction until final completion and acceptance of the work under this Contract. If, in the opinion of Engineer, Contractor’s hauling activities cause horizontal shear planes or slickensides, rutting, quaking, heaving, cracking, or excessive deformation of the berms or backfill areas, Contractor shall subsequently limit the type, load, or travel speed of the hauling equipment. Contractor may be required to remove, at no additional payment, berm material placed outside of prescribed slope lines. Approved berm or backfill material which is lost in transit or rendered unsuitable after being placed in the berm or backfill and before final acceptance of the work shall be replaced using a satisfactory method at no additional cost to Engineer. Any Unsuitable Material shall be excavated and removed from the berm or backfill and disposed, and the excavated area shall be refilled, at no additional cost to Engineer.

C. Volume: The “neat-line volumes” have been used by Engineer to prepare the estimates shown on the Bid Proposal Form. The volumes are estimates only and Contractor is responsible for interpreting the volume numbers in preparing his estimate for bidding. “Neat-line volumes” is defined as the unadjusted, raw quantities computed from the berm templates. The percentage for items including overbuilding, compaction, settlement,
foundation displacement, or construction waste, is the responsibility and decision of Contractor.

D. Tolerances: The berms shall be constructed to the grades, lines, and cross-sections shown on the Drawings. At every point a tolerance of 6 inch above or 0 inches below the prescribed grade will be permitted in the final dressing, provided that excess material is distributed to ensure that the crown of the berms drain to the PA interiors and that there are no abrupt humps or depressions in the surfaces.

E. Utilities: Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Work inside the pipeline easement may require excavation efforts to run parallel with the pipeline. Some utility engineers may require prior notification and/or onsite supervision of excavation operations. Coordination with the utility owner is the responsibility of the Contractor. Support uncovered lines or other existing work affected by the Contract excavation until approval for backfill is received. Report damage to utility lines immediately to Engineer.

3.02 SITE DRAINAGE AND DEWATERING

A. Drainage: Berm foundation areas, borrow areas, temporary stockpiles, and partially completed fill shall be kept continuously drained. Contractor shall establish/construct and maintain temporary drainage features (ditches, swales, ponds, basins, etc.) throughout the duration of construction, and grade the construction area to provide positive surface water runoff away from the construction activity. Prior to placement of fill, the areas shall be completely drained of standing water and allowed to dry so that the surface areas are firm enough for the operation of equipment thereon. Once drainage of the work area and sufficient drying of the foundation surfaces have been accomplished, excavation and the berm construction can proceed. It is the responsibility of Contractor to assess the soil and groundwater conditions and to employ necessary methods that will permit construction to proceed.

B. Dewatering: Surface and groundwater control shall be accomplished in coordination with the required excavation and berm construction to prevent sloughing of excavation slopes, boils, uplift and heave in the excavation and to eliminate interferences with orderly progress of construction. In the event of heavy rainfall or high tides, the surface and groundwater control may necessitate the use of temporary berms, diversion ditches, and pumps. A dewatering plan shall be submitted for review and approval. The borrow areas shall be drained continuously via drainage ditches which shall be connected to either interior or perimeter ditches during and after the completion of the work.

3.03 EXCAVATION

A. General: Excavation shall consist of removal of material in preparing the foundations to the lines and grades shown on the drawings, removal of material from ditches to the lines and grades shown on the drawings, removal of objectionable materials and obtaining required fill materials from the borrow areas.

B. Borrow Areas:

1. Borrow areas shall be located/identified and tested by Contractor as required to complete the work. Borrow areas shall be located within the PA, however, will include areas outside the existing perimeter berm and above the proposed dredge profile down to
groundwater. Borrow areas are subject to the restrictions stated on the drawings. Any other borrow areas need to be approved by the Engineer.

2. The soil profiles shown in Appendix A – Geotechnical Report, only represent general selective samples taken during initial subsurface soil investigation. Borrow areas shall be selected and tested by Contractor for conformance with the Perimeter Berm Material requirements stated in this specification. Contractor shall be aware that the PAs have received dredged materials periodically throughout the years. Contractor shall anticipate variable and extremely soft/wet recently dredged materials. Contractor’s Work Plan shall be revised, resubmitted, and approved by Engineer prior to use of any supplemental borrow areas.

3. Prior to performing any material excavation at borrow areas to obtain fill for berm construction, and before connecting new or improved berms to existing berms, the following surface preparation shall be performed:

   a. **Clearing and Grubbing:** Unless indicated otherwise on the drawings, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations. Remove stumps entirely. Grub out matter roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

   b. **Stripping:** Strip the topsoil of the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be stockpiled or disposed as approved by the Chief Construction Manager.

   c. **Unsuitable Material:** Remove vegetation, debris, oversized materials, decayed vegetable matter, sod, mulch, and rubbish.

4. Borrow areas shall be excavated to the extent necessary to obtain Suitable Materials but within the maximum limits stated on the drawings. Borrow areas shall be drained continuously and kept relatively dry during excavation. Interior stockpiles of Suitable Materials located within PAs shall be utilized as borrow materials if the material complies with the Perimeter Berm Material requirements of this specification.

5. The bottom of borrow areas shall be graded relatively smooth. Interior borrow areas shall be graded to drain towards the nearest drop-outlet structure, during and after the borrow excavation is completed. External borrow areas shall be graded to drain towards Barbors Cut both during and after the borrow excavation is completed.

C. **Degrading Existing Berms:** Excavate existing berms at the specified locations and to the lines and grades shown on the drawings. Excavated materials meeting the requirements for Perimeter Berm Material as defined in Paragraph 2.02, “Fill Materials”, may be reused to construct the new berms and for improvements to existing berms. Keep excavations relatively free from water. Excavations below indicated depths will not be permitted except to remove Unsuitable Material. Any over-excavated areas shall be backfilled to grade.

D. **Disposition and Stockpiling of Excavated Materials:** Excavated Suitable Material shall be incorporated in the appropriate zones of the berm templates. When direct placement is not practicable, Suitable Material from the excavation shall be stockpiled only in approved areas for subsequent use in other parts of the work for which it is specified herein or as indicated. Suitable Material in excess of the quantity necessary to construct backfills and berm shall be stockpiled for future construction work. No payment will be made for such stockpiling, nor for the reloading and hauling of this material to its final position in the berms.
E. Blending Materials: Blending materials from borrow areas may be performed to provide Perimeter Berm Material. If blending is performed, the material shall be mixed to create a relatively homogeneous material with clods less than 2 inches in diameter, and the material shall not contain any Unsuitable Materials as defined in Paragraph 2.02.D. The material shall be sampled and tested to show compliance with the properties in Paragraph 2.02.C.1.

3.04 EMBANKMENT CONSTRUCTION

A. General: Prior to beginning placement of fill materials on the berm foundation, notify Engineer that the foundation is ready to receive fill. No fill shall be placed on the berm foundation until these areas have been observed by Engineer or Engineer’s designated representative, and surveyed by Contractor.

B. Gradation and Distribution: The materials throughout the berms shall be graded and distributed so that the overall berm is free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material of the same class. If lenses, pockets, or layers of materials differing substantially in texture or gradation from surrounding material occur in the spread material, the layer shall be mixed by harrowing or another approved method to blend the materials. During the placing and spreading process, continuously maintain a force of workers adequate to remove roots, debris, and oversize stones from the berm materials.

C. Surface Preparation for Embankments: Prior to placing material for new berms, adding material to improve existing berms, and prior to connecting new berm sections to existing berms, the following surface preparation shall be performed:

1. Clearing and Grubbing: Unless indicated otherwise on the drawings, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations. Remove stumps entirely. Grub out matter roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

2. Stripping: Strip suitable topsoil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be stockpiled or disposed as approved.

3. Unsuitable Material: Remove vegetation, organics, debris, decayed vegetable matter, sod, mulch, and rubbish.

D. Foundation Preparation for New Embankments: Proof roll subgrade with one to two passes of a rubber tired tandem dump truck with a gross weight of 50,000 pounds or approved equivalent equipment in a systematic manner to ensure testing over all areas at speeds between 2 to 4 mph. Repair unstable areas identified during the proof rolling as specified.

E. Foundation Preparation of Existing Embankments: If there are holes, cavities and depressions in the foundation areas, including where the new berm will interface with existing berm, the foundation areas shall be scarified to a depth of 6 inches to provide bond between the foundation material and the fill; these areas shall then be back-filled with the same materials that is to be placed immediately above the foundation and fully compacted prior to the initial fill. The fill shall be placed in layers up to a maximum of 12 inches (loose), moistened as required, and compacted in accordance with the applicable provisions of this specification for the specific material type. Remove and replace Unsuitable Materials or very soft dredged materials with material by methods of displacing or excavation.

F. Foundation Preparation of Existing Dredge Material: In areas where the berms will be raised atop existing dredge material, the dredge material should be improved or replaced with semi-
compacted fill. The intent is to prepare about a 3-ft thick layer of semi-compacted material or improved dredge material to bridge the softer dredge material and allow the placement of compacted fill material above.

G. Equipment Traffic: Equipment traffic on a berm zone shall be routed to distribute the compactive effort as much as practicable. Ruts formed in the surface of a layer of spread material shall be filled before that material is compacted.

H. Compacted Material: Material for perimeter berms shall be placed and compacted as specified in Paragraph 3.04.K. Layers shall be started full out to the slope stakes and shall be carried substantially horizontal and parallel to the berm centerline with sufficient crown or slope to provide satisfactory drainage during construction. Compaction is not required for interior berms.

I. Benching into Existing Slopes: “Benches” or “steps” shall be cut into the existing perimeter berms before placing Perimeter Berm Material in horizontal compacted lifts in accordance with 3.04.K. The benches would be on the order of 2 to 4 feet in height and 4 to 6 feet in width. Sloping ground surfaces steeper than 1-Vertical to 6-Horizontal shall be stepped or benched to form a proper bond with the existing surface.

J. Moisture Control:

1. Compacted Perimeter Berm Material: The moisture content after compaction shall be as uniform as practicable throughout any one layer of impervious materials. Material that is too wet shall be spread on the embankment and permitted to dry, assisted by discing or harrowing, if necessary, until the moisture content is reduced to an amount within the specified limits. When the material is too dry, Contractor will be required to sprinkle each layer of the fill. Harrowing or other approved methods will be required to work the moisture into the material until a uniform distribution of moisture is obtained. The moisture content of Perimeter Berm Material shall be controlled so that hauling, spreading, and compacting equipment can operate with normal procedure without excessive rutting of the fill.

2. Insufficient Moisture for Suitable Bond: If, in the opinion of Engineer, the top or contact surfaces of a partial fill section become too dry to permit a suitable bond between these surfaces and the additional fill to be placed thereon, loosen the dried materials by scarifying or discing, dampen the loosened material to an acceptable moisture content, and compact this layer to densities comparable to the underlying embankment and in accordance with the applicable requirements of Paragraph 3.04.H.

3. Excessive Moisture for Suitable Bond: If the top or contact surfaces of a partially filled section become too wet to permit suitable bond between these surfaces and the additional fill to be placed thereon, the wet material shall be scarified and permitted to dry, assisted by discing or harrowing, if necessary. The material shall then be compacted in accordance with the applicable requirements of Paragraph 3.04.H.

4. Drying Wet Material: Material that is too wet shall be spread on the berm and permitted to dry, dried in the borrow area prior to bringing it to the berm, or disced or harrowed to promote drying, until the moisture content is reduced to workable condition.

5. Increase Moisture in Dry Materials: Contractor shall take measures to increase the moisture content of material that is too dry. The moisture content of material that is too dry can be adjusted on the berm or in the borrow area prior to bringing it to the berm. Add water to the fill material and then work the moisture into the material by harrowing or other approved methods until a uniform distribution of moisture within the specified limits.
is obtained. Water applied on a layer of fill on the berm shall be accurately controlled in amount so that free water will not appear on the surface during or subsequent to rolling. If too much water is added to a part of the berm, the rolling on that section of the berm shall be delayed until the moisture content of the materials is reduced to an amount within the specified limits.

6. Treating Source Material: If it is impracticable to obtain the specified moisture content by wetting or drying the material on the fill, Contractor shall pre-wet or dry the material at the source of excavation or in the borrow area.

K. Compaction

1. Compaction Equipment: Contractor shall apply appropriate means and methods for compacting fill material to achieve the compaction requirements stated herein.

2. Compacted and Semi-Compacted Requirements:
   a. Where compaction is specified, material shall be placed or spread in horizontal layers, each layer not more than 8 inches in compacted lift thickness.
   b. Where semi-compaction is specified, material shall be placed or spread in horizontal layers, each layer not more than 12 inches in compacted lift thickness.
   c. After a layer of material has been dumped and spread it shall be harrowed as required to break up and blend the fill materials and to obtain uniform moisture distribution. Harrowing shall be performed with a heavy disc plow, or other approved harrow, to the full depth of the layer. If one pass of the harrow does not accomplish the breaking up and blending of the materials, additional passes of the harrow shall be required.
   d. When the moisture content and the condition of the layer are satisfactory, the lift shall be compacted to the moisture density criteria presented herein.
   e. In areas which are not accessible by roller, the fill shall be placed in layers not more than 6 inches in compacted depth and compacted with an approved hand operated compactor to a density equal to that obtained in other areas which are accessible to rollers.
   f. Dumping, spreading, sprinkling, and compacting may be performed at the same time at different points along a section when there is sufficient area to permit these operations to proceed simultaneously.
   g. Compacted material shall be compacted to at least 95 percent of the maximum dry density at a moisture content between 3 percent “dry” and 3 percent “wet” of the optimum moisture content as determined by ASTM D698.
   h. Semi-compacted material shall be compacted to at least 85 percent of the maximum dry density at a moisture content between 3 percent “dry” and 3 percent “wet” of the optimum moisture content as determined by ASTM D698.

3.05 EROSION AND SLIDES

If erosion or sliding of any part of the berms occur during or after construction, but prior to acceptance, that portion of the berm shall be rebuilt with no additional expense to Owner. Where settlement of the berm, due to weak foundation conditions, develops to an extent that will make it
inadvisable, in the opinion of Engineer, to continue placement of additional materials, Engineer may omit further work on these portions of the embankment and to accept it as completed.

3.06 TURFING
Disturbed areas to include the repaired side slope, newly constructed outside slope and the crown of the containment dike shall be seeded per 32 92 19.16 Turfing.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 31 62 18 Add - STEEL PIPE PILES

PART 1    GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, materials, equipment, supervision, and every other thing necessary to furnish and drive steel pipe piles as described and specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities
SECTION 05 12 00.00 Mod – Structural Steel Framing
SECTION 35 31 16.20 Mod – Steel Sheet Pile Bulkhead

1.3 REFERENCES

A. AMERICAN PETROLEUM INSTITUTE (API)

B. AMERICAN WELDING SOCIETY (AWS)
   AWS D1.1/D1.1M (2010; Errata 2011) Structural Welding Code - Steel

C. ASTM INTERNATIONAL (ASTM)
1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

A. Preconstruction Submittals
   1. Installation Procedures
   2. Wave Equation Analysis

B. Shop Drawings
   1. Pile Placement
   2. Pile Placement Plan

C. Product Data
   1. Pile Driving Equipment
   2. Delivery, storage, and handling

D. Test Reports
   1. Wave equation analysis
   2. Dynamic pile analysis

E. Closeout Submittals
   1. Pile driving records

1.5 DELIVERY, STORAGE, AND HANDLING

Conform all delivery, storage, and handling of materials to the requirements specified herein. Develop and submit plans for the delivery, storage, and handling of piles at least 21 days prior to delivery of piles to the job site.

A. Delivery and Storage

Stack piles during delivery and storage so that each pile is maintained in a straight position and is supported every 10 feet or less along its length, ends inclusive, to prevent exceeding the maximum camber.

B. Handling

Lift piles using methods which do not cause permanent damage to the piles. Do not drag piles across the ground.
Inspect piles for excessive camber and sweep and for damage before transporting them from the storage area to the driving area and immediately prior to placement in the driving leads. Sweep curvature of the pile in the direction parallel to the pile, must be measured with the pile laying on a flat surface and is the distance between the centerline of the pile at the mid-length of the pile and the centerline of the pile at the end of the pile. The maximum permissible camber and sweep is 2 inches over the length of the pile. Piles having excessive camber or sweep will be rejected.

**PART 2 PRODUCTS**

2.1 MATERIALS

A. Pipe Piles

Pipe shall conform to the requirements of ASTM A252, seamless or welded with a minimum yield strength of 50 ksi. Provide mill certificates for pipe pile materials. All pipe material shall be new.

B. Weld Processes

Welds made at a permanent manufacturing facility shall be performed by either a submerged arc weld (SAW) or a double submerged arc weld process (DSAW). Welds shall have complete joint penetration. All welds shall be pre-qualified welds in accordance with AWS D1.1/D1.1M. Welds other than AWS pre-qualified welds shall be qualified under AWS acceptance procedures.

C. Weld Testing Requirements

A minimum of ten percent of each longitudinal weld made at a permanent manufacturing facility shall receive non-destructive testing (NDT) by either radiographic, radioscopic, real time imaging systems or ultrasonic methods that are in conformance with the requirements of AWS D1.1/D1.1M, or API Spec 5L. Submit pipe weld NDT records to the Port Authority. The repair criteria shall conform to the requirements of AWS D1.1/D1.1M, Section 6, for cyclically loaded non-tubular connections subject to tensile stress. If repairs are required in a portion of the weld, additional NDT shall be performed. The additional NDT shall be made on both sides of the repair for a length equal to 10 percent of the length of the pipe outside circumference. After the additional NDT is performed, and if more repairs are required that have a cumulative length equal to or more than 100 percent of the length of the pipe outside circumference, then the entire weld shall receive NDT.

2.2 FABRICATION OF PIPE PILING

A. General

Pipe piling shall have the wall thickness, diameters, and details as indicated on the drawings.

B. Welding

Perform all welding for piles in accordance with AWS D1.1/D1.1M, (except as modified in this section) using certified welders, welding operators, and tackers and qualified joint welding procedures.
C. Splices

All splices for pipe piling shall be made with continuous butt welds. All the butt welds shall be complete penetration, pre-qualified welds. Provide 100% radiographic or ultrasonic examination of the welds in accordance with AWS D1.1/D1.1M. Construct splices to maintain the true alignment and position of the pile sections.

2.3 COATING OF PIPE PILES

Coat pipe piles to the extent shown on contract drawings in accordance with 09 96 56.01 Std- Epoxy Coatings- Coal Tar.

PART 3 EXECUTION

3.1 PILE DRIVING EQUIPMENT

Select the proposed pile driving equipment at least 14 days prior to commencement of work, including hammers and other required items, and submit complete descriptions of the proposed equipment. Changes in the selected pile driving equipment will not be allowed after the equipment has been approved except as directed. No additional contract time will be allowed for Contractor proposed changes in the equipment.

A. Pile Driving Hammers

Provide impact and/or vibratory type pile driving hammers.

Submit information on the type of equipment proposed to be used, proposed methods of operation, pile driving plan including proposed sequence of driving production piles and dynamic testing, and details of all pile driving equipment and accessories.

Provide details of pile driving equipment and a Wave Equation Analysis of pile drivability for selection of the hammer along with a statement of driving procedures. The Wave Equation Analysis is to be completed by the Contractor's Engineer for each test pile location where different subsurface conditions exist and is to include the following information pertaining to the proposed pile driving equipment:

1. Submit Pile and Driving Equipment data, for each proposed pile hammer and pile type combination.

2. Copies of computer input and output sheets and graphs showing soil resistance versus blow count as well as maximum tension and compression stresses versus blow count. Analysis shall be run at the estimated tip elevation as well as other required elevations to define maximum stress levels in the pile during driving.

B. Impact Hammers

Provide steam, air, or diesel-powered impact pile hammers of the single-acting, double-acting, or differential-acting type. Hammers must be capable of hard driving up to 20 blows per inch. Provide boiler, compressor, or engine capacity sufficient to operate hammers continuously at the full rated speed. Hammers must have a gage to monitor hammer bounce chamber pressure for diesel hammers (except for open ended diesel hammers) or pressure at the hammer for air and steam hammers. This gage must be operational during the driving of piles and be mounted in an accessible location for monitoring by the Contractor and Engineer.
Provide bounce chamber pressure gage correction tables and charts for the type and length of hose to be used with the pressure gage to the Engineer. Obtain driving energy by use of a heavy ram and a short stroke with low impact velocity, rather than a light ram and a long stroke with high impact velocity. Position a pile cap or drive cap between the pile and hammer. Place hammer cushion or cap block between ram and the pile cap or drive cap. Hammer cushion or cap block must have consistent elastic properties, minimize energy absorption, and transmit hammer energy uniformly and consistently during the entire driving period. Submit the following information for each impact hammer proposed:

1. Make and model.
2. Ram weight (pounds).
3. Anvil weight.
4. Rated stroke (inches).
5. Rated energy range (foot-pounds).
6. Rated speed (blows per minute).
7. Steam or air pressure, hammer, and boiler and/or compressor (psi).
8. Rated bounce chamber pressure curves or charts, including pressure correction chart for type and length of hose used with pressure gage (pounds per square inch).
10. Cushion block dimensions and material type.

C. Vibratory Hammers

The use of vibratory hammers is dependent upon the Contractor’s ability to satisfactorily drive the piles. All piles initially driven using a vibratory hammer shall be driven to the required capacity in accordance with the approved refusal criteria using a power hammer. The vibratory hammer must provide for maintaining a rigid connection between the hammer and the pile. Submit the following information for each vibratory hammer proposed:

1. Make and model.
2. Eccentric moment (inch-pounds).
3. Dynamic force (tons).
4. Steady state frequency or frequency range (cycles per minute).
5. Vibrating weight (pounds).
6. Amplitude (inches).
7. Maximum pull capacity (tons).
8. Non-vibrating weight (pounds).


D. Pile Driving Leads

Support and guide hammers with leads capable of driving piles to their intended location and within tolerances specified.

E. Pile Extractors

Pile extractors may be vibratory and/or impact pile driving hammers. Impact hammers are required for pulling piles not extractable with vibratory hammers. Faulted piles shall be extracted.

F. Jetting Equipment

Jetting of piles is not permitted.

3.2 PRELIMINARY WORK

A. Wave Equation Analysis of Pile Drivability

1. Prior to driving any pile, the Contractor shall submit a pile Wave Equation Analysis, performed by the Contractors’ Engineer. This analysis shall take into account the proposed hammer assembly, pile cap block and cushion characteristics, the pile properties and estimated lengths and the soil properties anticipated to be encountered throughout the installed pile length based on static capacity analysis with consideration of driving gain/loss factors. Only one specific model of pile hammer may be used for each pile type and capacity.

2. The Wave Equation Analysis shall demonstrate that the piles will not be damaged during driving, shall indicate that the driving stresses will be maintained within the limits below and indicate the blow count necessary to achieve the required ultimate static pile capacities, stated within the contract drawings.

Allowable Driving Stresses

Steel

Compression: 0.9 f_y
Tension: 0.9 f_y

Where f_y is yield strength of steel.

3.3 INSTALLATION

The Contractor shall mark each pile prior to driving with horizontal lines (perpendicular to the longitudinal axis of pile) at one foot intervals, and the number of feet from pile tip at 5 foot intervals. For test piles to be re-struck as specified under subpart 3.4.2, mark the pile with horizontal lines at one inch interval for at least a foot above the reference line used for monitoring penetration. Inspect piles when delivered and when in the leads immediately before driving. Handle piles so as to protect pile coatings. Repair damage or defects in pile coatings as specified in 09 96 56.01 Std-Epoxy Coatings- Coal Tar. Cut piles at cutoff grade by an approved method.
A. Pile Driving Records

Submit proposed form for compiling pile driving records 14 days prior to commencement of work. Submit complete and accurate job pile driving records on a daily basis after completion of driving. Compile and submit accurate records of the pile driving operations on the approved sample pile driving records form. Include in driving records for each pile date driven, pile identification number, cross section shape and pile dimensions, location, deviations from design location, original length, ground elevation, top elevation, tip elevation, description of hammer used, number of blows required for each foot of penetration throughout the entire length of the pile and for each inch of penetration in the last foot of penetration, total driving time in minutes and seconds, and any other pertinent information as required or requested such as unusual driving conditions, interruptions or delays during driving, damage to pile resulting from driving, heave in adjacent piles, redriving, weaving, obstructions, and depth and description of voids formed adjacent to the pile.

Additional data required to be recorded for impact hammers includes the stroke height/rate of hammer operation (blows per min (BPM)), fuel settings throughout pile driving, make, size, and the length of the bounce hose. Additional data required to be recorded for vibratory hammers includes hammer power pack description, make, size, horsepower applied to pile, and hammer operating frequency.

B. Pile Placement and Tolerances in Driving

Develop and submit a pile placement plan at least 14 days prior to delivery of piles to the job site, which shows the installation sequence and the methods proposed for controlling the location and alignment of piles. Complete all foundation preparations in the area prior to the placement of piles for driving. Accurately place piles in the correct location and alignments, both laterally and longitudinally, and to the vertical lines indicated. Establish a permanent base line to provide for inspection of pile placement by the Owner during pile driving operations prior to driving piles. Baseline to be maintained during the installation of the piles.

A final lateral deviation from the correct location at the cutoff elevation of not more than 1 1/2 inches will be permitted for plumb and batter piles. Manipulation of piles will not be permitted, unless approved by the Owner. A variation of not more than 1/2 inch per 10 feet of pile length from the vertical for vertical piles nor more than 0.25 inch per foot of pile length from the required angle for batter piles will be permitted. A vertical deviation of not more than 2 inches from the correct cutoff elevations shown is permitted. Inspect piles for heave. Redrive heaved piles to the required tip elevation. Maintain the correct relative position of all piles by the use of templates or by other approved means such that the piles are not displaced during the installation of the pile cap. Redesign of pile caps or additional work required due to improper location of piles is the financial responsibility of the Contractor. Piles damaged or not located properly (unless pile head movements allowed) or exceeding the maximum limits for lateral and vertical deviation, or variation in alignment must be pulled and new piles redriven, or provide additional piles at locations directed by Engineer to no additional cost to the Owner.

C. Pile Penetration Criteria

The tip elevation for job/production piles will be verified based on the dynamic testing of selected piles during installation for the project.

Pile acceptance should be determined by the Geotechnical Engineer's representative based primarily on tip elevation as shown on the drawings and the pile penetration data from dynamic testing. The available geotechnical data for the project shall also be referenced for acceptance of the pile penetration acceptance. After piles have achieved tip elevation, the secondary requirement
is that the minimum axial resistance shown on drawings shall be achieved as estimated blow count and hammer performance.

D. Pile Driving

Pile driving operations should be observed by an Engineering Technician under the Geotechnical Engineer's supervision to determine whether the piles are encountering expected driving resistances and to note any problems during installation. Pile acceptance should be determined by the Geotechnical Engineer's representative based primarily on tip elevation and secondarily with blow count and hammer performance.

Notify the Port Authority 10 days prior to the date pile driving is to begin. Do not drive piles within 100 feet of concrete less than 7 days old. Drive all piles with hammers of the same model and manufacturer, same energy and efficiency, and using the same driving system. Operate hammers at all times at the speed and under the conditions recommended by the manufacturer. Where heave is anticipated, the sequence of installation must be such that pile heave is minimized by starting pile driving at the center of the group and proceeding outward. Prior to driving and with the pile head seated in the hammer, check each pile to ensure that it has been aligned correctly. Once pile driving has begun, keep conditions such as alignment constant. Drive each pile continuously and without interruption until the required tip elevation has been attained. Deviation from this procedure will be permitted only when driving is stopped by causes that reasonably could not have been anticipated. A pile that cannot be driven to the required depth because of an obstruction, as indicated by a sudden unexplained change in blow count or drifting, must be pulled and re-driven or cut off and abandoned, whichever is directed by Port Authority. After piles are driven, cutoff square as required at the indicated cutoff elevation. If, in driving, it is found that pile is not of sufficient length to give the capacity specified, notify the Port Authority, who will determine the procedure to be followed.

1. Heaved Piles

   When driving piles in clusters or under conditions of relatively close spacing, perform observations to detect heave of adjacent piles. Backdrive heaved piles to original depth of penetration.

2. Pulled Piles

   Pull and replace piles damaged or impaired for use during driving with new piles, or cut off and abandon and drive new piles as directed. Redrive piles pulled as directed and found to be in suitable condition at another location as directed. Replace piles pulled as directed and found to be damaged with new piles.

3. Long Piles

   Handle and drive piles carefully to prevent overstress of long slender piles.

4. Welding

   AWS D1.1/D1.1M. Provide 100 percent radiographic or ultrasonic examination of complete penetration butt welds.
3.4 PILE TESTING

A. Test Piles

Perform dynamic testing on piles as indicated. Order verification test piles a minimum of 5 feet longer in length than production piles. The Contractor is responsible for providing adequate length of the test piles to meet project design requirements to accommodate for testing equipment, templates, and other means and methods to install piles. The additional test pile length shall be driven only at the direction of the Contractor's Geotechnical Engineer. The Contractor's Geotechnical Consultant will use test pile data to determine "calculated" pile tip elevation. Drive test piles at the locations indicated. Drive test piles to indicated tip elevation. The test piles shall become a part of the finished work. A pile dynamic analyzer shall be provided and operated as specified in paragraph DYNAMIC PILE ANALYSIS during the driving of each test pile. Modify driving as required based upon recommendation of Contractor's Geotechnical Consultant and approval of the Port Authority.

The Contractor shall notify the Port Authority of the date and time for dynamic testing at least 10 days, and again at 72 hours, prior to testing.

B. Dynamic Pile Analysis

The purpose of dynamic testing is to provide supplemental information for evaluating pile hammer performance, driving stresses, and ultimate axial capacity. Dynamic testing shall be conducted during the entire time test piles are initially driven or re-driven and during pile restrike testing. Use test piles of type as specified elsewhere in this section. Equipment to obtain dynamic measurements, record, reduce and display its data shall be furnished and meet the requirement of ASTM D4945. The equipment shall have been calibrated within 12 months. Drive test piles at the locations indicated. The contractor shall employ an independent inspection firm, hereinafter referred to as the "Contractor's Geotechnical Consultant", experienced in the pile driving process, monitoring of test pile installation, and in the use of the Pile Driving Analyzer and its related equipment. The Contractor's Geotechnical Consultant and the dynamic monitoring operator shall have a minimum of five years’ experience in data acquisition from high strain dynamic pile testing and successful performance on at least two projects of similar size and scope and in similar geotechnical conditions in past two years. Dynamic pile analysis shall be performed as follows:

1. Each dynamic pile analysis shall be performed in two steps. The first step is to check the hammer, pile and soil performance, and to determine the suitability of the proposed hammer for the size, length and type of pile being installed for the soil types encountered as the piles are driven. This initial monitoring shall determine, efficiency of the hammer relative to specified efficiency, level of compressive and tensile stress in pile and extent/location of any pile damage caused by the initial driving. With each blow of the pile the information listed below shall be electronically recorded and analyzed by the Pile Driving Analyzer:

   a. Blow number
   b. Blow rate per minute and/or stroke.
   c. Input and reflected values of force and velocity.
   d. Value of upward and downward traveling force wave with time.
   e. Maximum and final transferred energy to pile, hammer system efficiency.
f. Maximum compressive stress, velocity, acceleration and displacement.

g. Maximum tensile stress in pile.

h. Pile structural integrity, damage detection, extent and location.

i. Ultimate axial capacity of pile by Case method.

If the pile, hammer and soil performance evaluation recommend changes to the hammer stroke or any other aspect for the pile driving operation these changes shall be incorporated into production pile driving in an effort to control excessive stresses and pile damage. Test piles damaged or broken during installation shall be replaced, incorporating driving modifications as determined by the Contractor's Geotechnical Consultant and reviewed and approved by the Contracting Officer. This procedure shall be repeated until allowable tensile and compressive stresses are achieved in the pile and/or pile damage is minimized. Selected initial driving records shall be subjected to rigorous computer analysis by the Case Pile Wave Analysis Program (CAPWAP) for determination of resistance distribution, and soil resistance.

2. Upon completion of test pile driving the piles shall be allowed to set-up for at least 72 hours. After evaluation of pile, hammer and soil performance by the Contractor's Geotechnical Consultant, the second step of the dynamic pile analysis may proceed. This portion of the evaluation requires striking the set-up piles a minimum of 20-50 times, or as directed by the Contractor's Geotechnical Consultant using the same hammer which was used for the test pile driving and which will be used for production pile driving. The hammer shall be "warmed up" and in optimal readiness prior to restriking, in order to avoid capacity losses during evaluation of restrike data. Maximum hammer energy shall be applied during restrike in order to fully mobilize the soil resistance. However, care should be exercised as to not overstress the pile. In addition to those items listed above, restrike driving records are to be subjected to rigorous computer analysis by the Case Pile Wave Analysis Program (CAPWAP) for determination of resistance distribution, soil resistance and properties, and plot of applied load vs. average pile displacement.

3. Performance Report:

a. Upon satisfactory completion of each dynamic load test a minimum of three copies of a Pile Performance Report shall be submitted for the Contractor by the Contractor's Geotechnical Consultant. The submittal shall be prepared and sealed by a registered Professional Engineer, registered with a minimum of five years' experience, at least two of which shall have been in data interpretation from high strain dynamic pile testing and successful completion of at least five projects of similar size and scope and in similar geotechnical conditions. The report shall be made within seven working days of the completion of the dynamic load test.

b. Submit a field summary report within one (1) day of testing. Submit a typed report summarizing the results of dynamic testing within one (1) week after dynamic testing is completed.

c. The report for the Dynamic Pile Analysis shall contain the following information:

i. Ultimate axial capacity of pile from Case Pile Wave Analysis Program (CAPWAP). Information resulting from analysis of a selected restrike blow.

ii. Maximum and final transferred energy, hammer system efficiency during pile installation.
iii. Maximum compressive stress, velocity, acceleration and displacement.

iv. Maximum tensile stress in pile.

v. Pile structural integrity, damage detection, extent and location.

vi. Blows per minute and blow number.

vii. Input and reflection values of force and velocity, upward and downward traveling force wave with time.

viii. Pile skin friction and toe resistance distribution.

ix. Maximum energy transferred to pile.

d. The maximum allowable pile design load will be proposed by the Contractor's Geotechnical Consultant based upon the results of a satisfactory pile load test conducted on a pile driven as specified herein and shall include the effects of load transfer to the soil above the foundation stratum. If the soil resistance measured on restrike is less than the Nominal Pile Resistance shown on the plans, the Engineer may direct the Contractor to drive all or a portion of the remaining test pile length and repeat the restrike testing. The Contractor will be notified by the Engineer of the necessity to perform a second restrike test within 3 days of the receipt of the test results from the initial restrike.

e. After submission of all dynamic pile driving analyses and a report from testing agency, the Engineer will review information, make a final determination of production pile lengths, and modify and issue revised drawings. The revised drawings shall be provided to the Contractor 14 days after submittal and acceptance of Dynamic Pile Test Report. The Engineer will also develop acceptance criteria for installation of production piles based on the Dynamic Pile Test Report.

4. The equipment to be used for dynamic testing of the pile hammer and soil performance and for dynamic load testing of the test pile shall be either a model GCPC or a PAK Pile Driving Analyzer as manufactured by Pile Dynamics, Inc., of Cleveland Ohio or approved equivalent.

5. The Contractor's Geotechnical Consultant shall be available throughout the pile driving operation to consult with the Contracting Officer when required by the Contracting Officer.

End of Section
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 32 11 33.16 Add - CEMENT STABILIZATION OF SUBGRADE

PART 1  GENERAL

1.1  SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the stabilization of subgrade or existing sub-base for pavements and railroads by the pulverization of soil; addition of Portland cement; and mixing, wetting and compacting the mixed material to the required density. This Item applies to natural ground, embankment, or existing pavement structure and shall be constructed as described and specified herein and as shown on the Drawings and all other applicable standards and regulations.

1.2  RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities
SECTION 31 23 00.00 Std – Excavation and Fill
SECTION 32 11 13.13 Std – Lime Treated Subgrade

1.3  REFERENCES

A.  ASTM International Publications; latest editions:

   ASTM C-150: Standard Specification for Portland Cement
   ASTM D-558: Standard Test Methods for Moisture-Density Relations of Soil-Cement Mixtures
   ASTM C-595: Standard Specification for Blended Hydraulic Cements
   ASTM D 2922: Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods

B.  Tex-120-E: Test Procedure for Soil-Cement Testing

C.  TxDOT DMS 4600: Hydraulic Cement

1.4  SUBMITTALS

A.  Product Data: Portland Cement Mill Certificates.

B.  Delivery Tickets: Truck weigh tickets from a certified scale, or certified invoice and acceptance documentation showing weight of bags delivered.
1.5 HANDLING AND STORAGE

Cement shall be stored and handled in closed weatherproof containers until immediately before application. If storage bins are used, they shall be completely enclosed. If cement is furnished in trucks, each truck shall have a weigh ticket from a certified scale. If cement is furnished in bags, each bag shall bear the manufacturer's certified weight. Bags varying more 5 percent from that weight may be rejected.

PART 2 PRODUCTS

2.1 MIX DESIGN

The Port Authority will determine the target cement content and optimum moisture content to produce a stabilized mixture that meets the strength requirements.

The target amount of dry cement added to existing untreated soil shall be 6 percent, unless otherwise indicated on the drawings. The amount of dry cement added to existing lime-treated soil shall be 4 percent, unless otherwise indicated on the drawings.

2.2 MATERIALS

A. Soil:

Soil shall consist of material free from vegetation or other objectionable matter encountered in the existing subgrade, and other approved material used in preparation of the subgrade in accordance with this specification. Soil to receive cement stabilization shall not have a PI greater than 10 as determined by ASTM D 4318.

B. Portland Cement:

Cement shall be Type I, IA, II, or IIA of a standard brand of Portland cement conforming to ASTM C-150, or Type IS conforming to ASTM C-595.

C. Water:

Water shall be clean, clear, and free from oil, acid, alkali, or organic matter.

D. Bituminous Prime Coat:

When permitted for curing purposes, the types, grades, and controlling specifications and application temperatures for the bituminous material are given in Table 2.

<table>
<thead>
<tr>
<th>Type and Grade</th>
<th>Specification</th>
<th>Application Temperature (Deg F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emulsified Asphalt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS-1, SS-1</td>
<td>ASTM D 977</td>
<td>75-130</td>
</tr>
<tr>
<td>CRS-1</td>
<td>ASTM D 2397</td>
<td>75-130</td>
</tr>
</tbody>
</table>
PART 3 EXECUTION

3.1 EQUIPMENT

Equipment necessary for the proper construction of the work shall be on the project, in first-class working condition prior to the start of construction operations. The Contractor shall at all times provide sufficient equipment to enable continuous prosecution of the work and its completion in the required number of contract days.

Portland cement treatment for materials in place may be constructed with any machine or combination of machines and auxiliary equipment that will produce results as outlined in this Section.

Mixing may be accomplished by (1) a multiple-pass traveling mixing plant or (2) a single-pass traveling mixing plant.

The equipment provided by the Contractor shall be operated by experienced and capable workmen and shall be that necessary to provide a cement treatment meeting the requirements herein specified.

3.2 TEST SECTION

Contractor shall complete a test section of a minimum of one truck, or 10-tombs, of cement, to establish application and mixing procedures that will result in a product meeting the requirements of this Section, prior to full-scale production. Additional cement or rework needed to achieve an acceptable finished test section shall be at the Contractor’s expense. Test sections meeting the requirements of this Section may be incorporated into the work. Test sections to be inspected and accepted by Chief Construction Manager prior to full-scale production.

3.3 CONSTRUCTION

A. General:

It is the primary requirement of these specifications to secure a completed course of treated material containing a uniform Portland cement mixture free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of work, to process a sufficient quantity of material to provide full depth as shown on the Drawings, to use the proper amount of Portland cement, maintain the work and rework the courses as necessary to meet the above requirements.

Cement treatment shall not be mixed or placed when the air temperature is below 40°F and is falling, but may be mixed or placed when the air temperature is above 35°F and is rising, the temperature being taken in the shade and away from artificial heat and with the further provision that cement treatment shall be mixed or placed only when weather conditions, in the opinion of the Chief Construction Manager, are suitable.

Prior to beginning the cement stabilization treatment, the roadbed shall be graded and shaped as required to construct such Portland cement treatment for material in place in conformance with the lines, grades, thicknesses and typical cross sections shown on the Drawings and specified herein.

The subgrade shall be firm and able to support without displacement the construction equipment and the compaction hereinafter specified. Soft or yielding subgrade shall be corrected and made stable before construction proceeds.
Remove any stones retained on a 1-3/4 inch sieve, as well as deleterious substances such as sticks, debris, and organic matter from the required mixing depth of the subgrade.

The depth of each course to be stabilized with cement shall be as shown on the Drawings or as described in these Technical Specifications. If the depth is not so described, it shall be eight inches (8") for each course. No layer shall be in excess of 8 inches nor less than 4 inches in compacted thickness.

The soil shall be so pulverized that, at the completion of moist-mixing, 100 percent passes a 1-3/4-inch sieve exclusive of gravel or stone retained on these sieves.

B. Application of Cement (Roadmix):

If a bulk cement spreader is used, it shall be positioned by string lines or other suitable method during spreading to insure a uniform distribution of cement.

Cement shall be applied only to such an area that all the operations can be continuous and completed in daylight within 6 hours of such application.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit uniform and intimate mixture of soil and cement during dry mixing operations, and it shall not exceed 2 percent over the specified optimum moisture content for the soil cement mixture.

Lime-treated subgrade may tend to become very dry upon application of cement. Contractor shall be responsible for application of water as necessary to maintain the moisture content required to achieve the specified density.

No equipment, except that used in spreading and mixing, will be allowed to pass over the freshly spread cement until it is mixed with the soil, compacted, and cured.

C. Mixing and Processing:

Either method (1) or (2) below shall be used at the option of the Contractor.

1. Multiple-Pass Traveling Mixing Plant:

After the cement has been applied it shall be dry-mixed with the soil. Mixing shall continue until the cement has been sufficiently blended with the soil to prevent the formation of cement balls when water is applied. Any mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

Immediately after the dry mixing of soil and cement is complete, water as necessary shall be uniformly applied and incorporated into the mixture. Pressurized equipment and supply provided shall be adequate to ensure continuous application of the required amount of water to sections being processed within 3 hours of application of the cement. Proper care shall be exercised to insure proper moisture distribution at all times. After the last increment of water has been added, mixing shall continue until a thorough and uniform mix has been obtained.

2. Single-Pass Traveling Mixing Plant:

After the cement has been applied it shall be sufficiently dry-mixed with the soil to prevent the formation of cement balls when water is applied. Un-pulverized, dry soil lumps in the
soil cement mixture immediately behind the mixer will not be allowed. Should this condition prevail, the Contractor shall "pre-wet" the raw soil as necessary to correct this condition.

The mixer shall be provided with means for visibly and accurately gaging the water application. The water shall be applied uniformly through a pressure spray bar.

After cement is spread, mixing operations shall proceed as follows:

The mixer shall in one continuous operation mix the air-dry soil and cement full depth, add the required moisture uniformly, thoroughly moist-mix the soil, cement and water, spread the completed soil cement mixture evenly over the machine processed width of the subgrade and leave it in a loose condition ready for immediate compaction.

Compaction of the soil and cement mixture shall begin within 30 minutes. At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the total width of completed work to form a true vertical face free of loose and shattered material.

At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the total width of completed work to form a true vertical face free of loose and shattered material.

Cement treatment for large, wide areas shall be built in a series of parallel lanes of convenient length and width meeting the approval of the Chief Construction Manager.

D. Compaction and Finishing:

The material shall be compacted to not less than ninety-five percent of the maximum laboratory dry density determined by Method "A" of ASTM D-558. In-place density will be determined in accordance with ASTM D-2922.

When the uncompleted soil-cement mixture is wetted by rain so that such density cannot be achieved at the time of final compaction, the entire section shall be reconstructed in accordance with these specifications at the sole expense of the Contractor.

Prior to the beginning of compaction, the mixture shall be in a loose condition for its full depth. At the beginning of compaction, at least 60 percent of the soil shall pass a No. 4 sieve, 85 percent shall pass a ¾ inch sieve, and 100 percent shall pass the 1-¾ inch sieve. The loose mixture then shall be uniformly compacted to the specified density within 2 hours.

After the soil and cement mixture, water shall be uniformly applied as needed and thoroughly mixed in. The surface shall then be reshaped to the required lines, grades and cross section and then lightly scarified to loosen any imprint left by the compacting or shaping equipment.

The resulting surface shall be thoroughly rolled and "clipped", "skinned" or "tight bladed" to a depth of approximately ¼ inch, removing all loosened soil and cement from the section. The surface shall then be thoroughly compacted, adding small increments of moisture as needed during rolling. If plus No. 4 aggregate is present in the mixture, one complete coverage of the section shall be made immediately after the "clipping" operation. Surface finishing methods may be varied from this procedure provided a dense, uniform surface, free of surface compaction planes is produced. The moisture content of the surface material must be maintained at its specified optimum during all finishing operations. Surface compaction and finishing shall proceed in such a manner as to produce, in not more than 2 hours, a smooth, closely knit surface, free of cracks, ridges or loose material conforming to the crown, grade and line shown on the Drawings.
The surface of a stabilized layer shall show no deviations in excess of ¼ inch in 10 feet. The completed thickness of the stabilized course shall be within ½ inch of the thickness indicated.

It is the intent of these specifications that the Contractor construct the required depth of cement treatment in one homogeneous mass. The addition of thin stabilized layers will not be permitted in order to provide the minimum specified depth.

E. Curing:

1. Protection and Cover:
   After the cement treated course has been finished as specified herein, the surface shall be protected against rapid drying by one of the following curing methods for a period not less than 3 days or until the surface or subsequent courses are placed:

   a. Maintain in a thorough and continuously moist condition by sprinkling.

   b. Apply an asphalt emulsion membrane (0.05 to 0.20 gallons per square yard) to the treated course immediately after same is completed. Membrane should be sufficient to completely cover and seal the total surface of the base and fill all voids. If the Contractor elects to use this method, it shall be the Contractor’s responsibility to protect the asphalt membrane from being damaged by traffic by either sanding or dusting the surface of same. The asphalt membrane may remain in place when the proposed surface or other base courses are placed.

2. Surface:
   The surface or base course may be applied on the finished base as soon after completion as operations will permit.

3.4 TESTING

Moisture-density relationship (Proctor) testing, compaction testing, thickness, grade and surface testing will be performed by a material testing laboratory retained by Chief Construction Manager.

3.5 TRAFFIC

Completed sections of cement treated material in place may be opened to construction equipment and to limited traffic after the curing period, with Chief Construction Manager approval, provided the cement treated course has hardened sufficiently to prevent marring or distorting the surface by equipment or traffic.

3.6 MAINTENANCE

The Contractor shall be required to maintain the cement treated course in good condition until all contract work has been completed and accepted. Maintenance shall include immediate repairs of any defects that may occur. This work shall be done by the Contractor at his own expense and repeated as often as may be necessary to keep the area continuously intact. Faulty work shall be replaced for the full depth of treatment.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

The work covered in this Section consists of furnishing labor, equipment, and materials to prepare the seed bed, plant seed, and fertilize to complete turfing.

1.2 MEASUREMENT AND PAYMENT

Measurement and payment for turfing will be paid in accordance with provisions of the SECTION (PLACEHOLDER)

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

A. U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1940; R 1988; R 1998) Federal Seed Act

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

A. SD-03 Product Data Equipment List; A list of proposed seeding and mulching equipment, including descriptive data and calibration tests.

B. Delivery - Delivery schedule shall be submitted at least 10 calendar days prior to the date of the first delivery.

C. SD-07 Certificates - Seed; For mixture, percent of live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested, and State certification.

D. Fertilizer; For chemical analysis and composition percent.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Seed Protection
a. Protect from drying out and from contamination during delivery, on-site storage, and handling.

B. Fertilizer Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to State and Federal laws. Instead of containers, fertilizer may be provided in bulk with a certificate indicating the above information.

C. Storage

1. Material Storage

   a. Materials shall be stored in approved areas. Seed and fertilizer shall be stored in cool, dry locations away from contaminants.

1.6 TIME LIMITATIONS

A. Seed

1. Apply seed within 24 hours after seed bed preparation.

PART 2- PRODUCTS

2.1 SEED

A. Classification

Provide State-certified seed of the latest season’s crop delivered in original sealed packages, bearing producer’s guaranteed analyses for percentages of mixtures, purity, germination, weed seed content, and inert material. Seed shall be labeled in conformance with AMS Seed Act and applicable State seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Seed shall be planted at the rate per acre specified below:

<table>
<thead>
<tr>
<th>Planting Window</th>
<th>Seed Type</th>
<th>Pure Seed Pounds per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 March thru 31 October</td>
<td>Hullled Common or Coastal Bermuda (Cynodon Dactylon)</td>
<td>40</td>
</tr>
<tr>
<td>1 November thru 28 February</td>
<td>Hullled Unhulled Common or Coastal Bermuda (Cynodon Dactylon) Gulf Annual Rye (Lolium multiflorum)</td>
<td>10 20 40</td>
</tr>
</tbody>
</table>

NOTE: Pure Live Seed = % Purity x (% Germination + % Hard Seed)/100
B. Quality

Seed shall conform to the applicable State seed laws. Weed seed shall not exceed 1 percent weight of the total mixture.

2.2 TOPSOIL

A. On-site Topsoil

Available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with the provided Technical Specifications. Suitable material shall be used as topsoil on surfaces where turfing is specified.

2.3 FERTILIZER

Fertilizer shall be commercial grade, free flowing and uniform in composition. Fertilizer for fertilizing with seeding shall be 13-13-13 Grade.

2.4 MULCH

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

A. Wood Cellulose Fiber Mulch

Wood Cellulose Fiber Mulch shall not contain growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate visual metering during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH ranges from 4.5 to 6.0.

B. Paper Fiber Mulch

Paper fiber mulch shall be recycled newsprint that is shredded for the purpose of mulching seed.

2.5 WATER

Source of water shall be of suitable quality for irrigation, containing no elements toxic to plant life (and shall be approved).

PART 3 - EXECUTION

3.1 GENERAL

Seeding and fertilizing operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant variance to the turfing operations, proposed times shall be submitted and approved. Seeding and fertilizing shall be accomplished on the containment dike and berm within the limits shown on the plans.

3.2 SITE PREPARATION

Areas to be seeded shall be cultivated to a depth of at least 4 inches. The seed beds shall be cultivated sufficiently to reduce the soil to a state of good tilth when the soil particles on the surface are small enough and lay closely enough together to prevent the seed from being covered too deeply or not deeply enough. Large clumps of soil shall be broken apart and the seedbed surface shall be consistently smooth for
optimum germination. Large roots, rocks, and other debris shall be removed.

3.3 APPLICATION OF TOPSOIL

Prior to placing topsoil, the subgrade shall be scarified to a minimum depth of 4 inches for bonding of topsoil with subsoil. The topsoil shall be evenly spread to a minimum depth of 4 inches. Topsoil shall not be spread when excessively wet or dry. Irregularities in finished surfaces shall be corrected to eliminate depressions. Debris and stones larger than 1-inch remaining on the surface after tillage shall be removed. Additional topsoil may be obtained from a local off-site source at no additional cost to the Owner.

3.4 APPLICATION OF FERTILIZER

Fertilizer shall be applied at the rate recommended for mixing simultaneously with seed and mulch in the hydraulic application.

3.5 SEEDING

A. General

Prior to seeding, the previously prepared seed bed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

B. Applying Seed

1. Hydroseeding

Seed and fertilizer shall be added to water and thoroughly mixed at the rates specified. Wood cellulose fiber or shredded paper fiber mulch shall be added at the rates recommended by the manufacturer after the seed, fertilizer, and water have been thoroughly mixed to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

2. Mulch

Wood cellulose or paper fiber mulch for use with hydraulic application of seed and fertilizer shall be applied as part of the hydro-seeding operation.

3. Equipment List

The equipment to be used and the methods of seeding shall be subject to inspection and approval.

3.6 PERMANENT PERENNIAL GRASS ESTABLISHMENT

The turf establishment shall result in satisfying the "Final Stabilization" requirement of the National Pollutant Discharge Elimination System (NPDES) regulations which state that uniform 70 percent density coverage of a warm-season perennial sod-forming (turf) grass shall be established.
A. Final Stabilization

A satisfactory stand of grass from the seeding operation is defined as a minimum of 10 warm-season perennial grass plants per square foot. Areas 100 square feet or larger, that are not covered by a satisfactory stand of grass shall be re-planted. A satisfactory stand of grass will not be accepted as “final stabilization” until a uniform 70 percent density coverage of a warm-season perennial grass has been established.

B. Final Inspection

A final inspection will be held by the Contracting Officer to make note of deficiencies in seeding coverage. Areas not properly seeded as “final stabilization” shall be repaired by the Contractor.

3.7 PROTECTION OF TURF AREAS

Immediately after turfing, protect areas against traffic and other use.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS FOR

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Spilmans Island Bulkhead & Pipeline Protection Wall

SECTION 33 40 00.13 Add – STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes the furnishing, placing and construction of new storm drainage systems and/or the extension or modification of existing storm drainage systems including storm sewers, manholes, inlets, outfall structures and miscellaneous drainage structures for pavements, roadways, railroads, and ditches, as described and specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std - Measurement of Quantities
SECTION 03 21 00.00 Std - Reinforcing Steel
SECTION 03 31 00.00 Std - Structural Concrete
SECTION 31 23 33.00 Std - Trenching and Backfilling
SECTION 31 41 33.00 Std - Trench Safety System

1.3 REFERENCES

A. ASTM International Publications, latest editions:

ASTM A-48 Standard Specification for Grey Iron Castings,
ASTM A-760 Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A-798 Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A-862 Practice for Application of Bituminous Coatings to Corrugated Steel Sewer and Drainage Pipe
ASTM C-32 Specification for Sewer and Manhole Brick
ASTM C-33 Standard Specification for Concrete Aggregates
ASTM C-76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C-443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C-1433 Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
1.4 SUBMITTALS
A. Product Data for: Pipes, Box Sections, Manholes, Inlets, Junction Boxes, Frames and Covers, Fittings, Select Backfill Material, Sleeves
B. Shop drawings and material data for Pipes, Box Sections, Manholes, Inlets, Junction Boxes.

1.5 HANDLING AND STORAGE
A. Load and unload pipe and other accessories by use of hoists, skids, or other suitable means, to avoid damage. Keep interior free from dirt and foreign matter during laying operations by plugging or other suitable method. Thoroughly clean interior of pipe of foreign material before lowering into trench or suspending.

The Contractor shall use great care in unloading and handling corrugated metal pipe so that the protective coating is not disturbed. Coating that is scraped off shall be replaced in the field with a hot-bituminous mix. Pipe that is dented, or has cuts through the zinc coating, will be rejected.

PART 2 PRODUCTS

2.1 MATERIALS
A. Reinforced Concrete Pipe:
All reinforced concrete pipe, shown on the Drawings, shall be circular precast tongue and groove or bell and spigot pipe conforming to ASTM Specification C-76 for Class III, Wall B, except under railroad tracks the pipe shall conform to ASTM Specification C-76 for Class IV, Wall B. 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 (10') from center line of track as measured at right angles to track. The pipe must be stamped by a competent testing laboratory as evidence of compliance with the ASTM Specifications. All reinforced concrete pipes shall be marked with pipe class, date of manufacture, manufacturer's name and location of elliptical reinforcement, as required by the above specifications.

B. Corrugated Metal Pipe:
1. All corrugated metal drainage pipes shown on the Drawings shall be fabricated in accordance with ASTM Specifications A-760, latest edition, The diameter, length and material gauge thickness for the pipes required shall be furnished as shown on the Drawings.
2. Band couplers shall be used to join sections of corrugated metal pipes as 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. and minimum 2-ft wide. Coupler bolts shall be furnished galvanized. Except as herein specified, band couplers shall conform to ASTM A-760, latest revision.
3. All corrugated metal pipe and band couplers shall be fully bituminous coated. Bituminous coating shall conform to the ASTM A-862, latest revision.
4. The Contractor shall install corrugated metal pipe in accordance with ASTM Specifications A-798, latest revision.
C. Reinforced Concrete Box Sewer:
Precast reinforced concrete box sewers shall conform to ASTM C-1433 extra heavy duty requirements. Boxes shall be machine-made or cast by process which will provide for uniform placement of concrete in forms and compaction by mechanical devices to produce dense, structurally sound concrete.

D. Concrete:
Except as provided otherwise in the Technical Specifications, concrete for reinforced concrete box sewers, inlets, junction boxes, manholes and other drainage structures shall use Class C concrete as described in the Technical Specifications. The materials, proportioning, testing, mixing, placing, forms and finishing shall be in accordance with the requirements of such Technical Specifications.

E. 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 the Technical Specifications. The fabrication, splicing, placing and support of such bars shall be in accordance with the requirements of such Technical Specifications.

F. 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 achieved in any position in which manhole cover is seated in the frame. Cast iron shall conform to ASTM Specification A-48 for Class 35 Gray Cast Iron and ASTM A-536 Ductile Iron Castings.

PART 3  EXECUTION
3.1  PIPE INSTALLATION
A. Inspection:
Carefully examine each piece of pipe for defects and compliance with these specifications before placing pipe in the trench. Pipe shall be rejected for cracks sufficient to impair strength or serviceability. The pipe must be stamped as evidence of compliance with the ASTM Specifications.

B. Trenching and Backfill:
The trench excavation for pipe, manholes, inlets, shall be performed in accordance with requirements of Section for Trenching and Backfilling. No box sewer or drainage pipe 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 insure 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.

C. Laying Pipe:
Start laying pipe at the outfall or low end with the tongue or spigot pointing in the direction of flow. Pipe shall be laid straight and true to the lines and grades indicated on the Drawings. As each pipe joint is laid, protect mouth of pipe to prevent entrance of earth or bedding material. No pipe shall be laid that has spalls or cracks on either end that would affect the tightness of the joint.
The corrugated metal pipe shall be laid with the inside circumferential laps pointing downstream and with longitudinal laps at the sides.

D. Jointing:

Maintain a clean and dry joint surface. Place Ram-Nek plastic gasket strips around tongue of concrete pipe. Handle pipe so gasket is not disturbed. For bell and spigot joints install rubber gasket. Support pipe by crane or backhoe while pipe is shoved home. Joints shall not be covered with backfill until inspected and approved by the Construction Manager. Joints shall conform to ASTM C-443.

For corrugated metal pipe, as band couplers are being tightened, the coupler shall be struck with a heavy hammer around the upper two-thirds (2/3) 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.

After joints have been inspected and approved, backfill shall be placed to the spring line of the pipe in accordance with specifications for backfill method. Alignment shall then be checked between manholes. If alignment is found to be true with no pipes misplaced, line will be approved, by the Construction Manager, for continuation of backfill. Otherwise, misalignment shall be corrected, with specified bedding, before such approval will be granted.

E. 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 BOX SEWER INSTALLATION

A. Bedding:

Bed box sections on foundation of firm and stable material accurately shaped to conform to their bases. Install bedding as specified in the Technical Specifications and drawings. When required by drawings, use special bedding material. When single-cell box sections are placed in parallel for multi-cell installation, place in conformance with details shown on drawings.

B. Placement:

Carefully lower box sections to bottom of trench and lay accurately in line and grade, with spigot or tongue end downstream entering bell or groove end to full depth and in such a manner as not to drag foreign material into annular space.

C. Jointing:

Join box sections together and match so that they will form continuous smooth and uniform invert. Place Ram-Nek plastic gasket strips around tongue of box section.

D. Backfilling:

After box has been properly jointed and bedded, commence backfilling in accordance with the Technical Specifications and drawings.

3.3 MANHOLES AND JUNCTION BOXES

A. Manholes and Junction Boxes shall be precast concrete constructed at locations shown on the Drawings, in accordance with the details shown. Seal joints in precast manholes by bedding sections in cement mortar or asphalt mastic.

B. Precast concrete manhole bases shall be constructed monolithic with the manhole section.

C. Maintain minimal clearances between manhole or junction box wall and other utilities as shown in the Drawings.

D. Install manhole top rims to the elevation indicated on the Drawings. Rack manholes as necessary to fall behind future or existing curb.
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. The inverts of the storm drains 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.

3.4 INLETS

A. All inlets shall be precast concrete, unless otherwise approved. Inlets shall be constructed to line and grade at the locations and in accordance with the details shown in the Drawings.

B. All inlet leads shall be neatly cut off at the inside face of inlet or box wall and pointed up with mortar.

C. Shape floor of inlets and boxes by filling with mortar to provide channels between ends of pipes.

D. Cast iron inlet plate frames shall be accurately adjusted to line, grade, and slope, and grouted in place with mortar.

3.5 MISCELLANEOUS DRAINAGE STRUCTURES

All miscellaneous and special drainage structures shall be constructed of precast concrete, unless otherwise indicated, and to the location, line and grades and in accordance with details shown on the Drawings.

END OF SECTION
PORT OF HOUSTON AUTHORITY

TECHNICAL SPECIFICATIONS

HOUSTON SHIP CHANNEL EXPANSION CHANNEL IMPROVEMENT PROJECT

Segment 3 – Barbours Cut Channel, Morgan’s Bulkhead

SECTION 35 31 16.20 Add - STEEL SHEET PILE BULKHEAD

PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes:

A. Furnishing all material necessary to complete the bulkhead and anchorages as shown on the Drawings, except material to be furnished by the Port Authority as specifically provided in these Technical Specifications.

B. Receiving and hauling to the site materials furnished by the Port Authority.

C. Furnishing all labor, equipment, supervision, and any other thing necessary to complete the bulkhead and its anchorage system, including coating of sheet piles, wales, steel caps, and steel batter piles, and wrapping tie rods.

1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities

SECTION 03 31 00.00 Add – Structural Concrete

SECTION 03 21 00.00 Std – Reinforcing Steel

SECTION 31 62 16.16 Add – Steel H Piles

1.3 REFERENCES

A. ASTM International Publications, latest editions:

ASTM A-6    Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

ASTM A-36   Standard Specifications for Structural Steel

ASTM A-108  Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
1.4 SUBMITTALS

A. Submit description of proposed pile-driving equipment at least two weeks prior to driving piling. Data shall include:

1. Make and model of pile driving hammer, including capacity and rated energy.

2. Weight of cap block assembly, cushion dimensions, type of cushion material, and cushion stiffness.

3. Submit a Wave Equation Analysis of pile drivability (WEAP) for selection of the hammer along with a statement of driving procedures. The Wave Equation Analysis is to be completed by the Contractor's Geotechnical Consultant for each pile type and for each location where different subsurface conditions exist and is to include the following information pertaining to the proposed pile driving equipment:

B. AASHTO Publications, latest edition:

AASHTO M-36 Standard Specifications for Corrugated Metal Culvert Pipe

ASSHTO M-190 Standard Specifications for Bituminous Coated Riveted Corrugated Metal Culvert Pipe and Pipe Arches

C. SP 10 Steel Structures Painting Council 'Near-White" Blast Cleaning

D. AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings

E. American Welding Society, latest edition:

Structural Welding Code – Steel; Serial Designation AWS D1.1
a. Complete Pile and Driving Equipment data, for each proposed pile hammer and pile type combination.

b. Copies of WEAP computer input and output sheets and graphs showing soil resistance versus blow count as well as maximum tension and compression stresses versus blow count. Analysis shall be run at the estimated tip elevation as well as other required elevations to define maximum stress levels in the pile during driving.

c. The Wave Equation Analysis shall demonstrate that the piles will not be damaged during driving, shall indicate that the driving stresses will be maintained at less than 0.9 times fy (yield strength of steel), in both tension and compression.

d. The services of an independent, Registered Professional Geotechnical Engineer, licensed in the State of Texas, and experienced in soil mechanics and Pile Foundation analysis, shall be hired by the Contractor to perform the work stated above. The Geotechnical Consultant shall be independent of the Contractor and shall have no employee of employer relationship which could constitute a conflict of interest.

B. Submit detailed fabrication and erection drawings for steel sheet piles, king/pipe piles, fabricated wales, tie rods, turnbuckles, heavy plate washers and accessories prior to installation. Drawings shall include:

1. Detailed bulkhead wall layout drawings, indicating each standard steel sheet pile, each king/pipe pile, each special fabricated section, each corner section, and showing quantity and length of each type; including tie rods, anchor walls, fabricated wales, etc.

2. Details of special fabricated sections, including complete dimensions and minimum section properties.

3. Details of wales, wale splices, fixing bolts and heavy plate washers.

C. Submit manufacturer’s product data and material certification that steel sheet piles, connectors, tie rods, tie rod wrapping/coating system, couplers, sleeve nuts and hardware meet the specified requirements.

D. Submit certification that surface preparation and protective coating have been applied in conformance with specifications and/or manufacturers requirements.

E. During pile driving, submit records to the Chief Construction Manager each day, including the following for king/pipe piles, and steel sheet pile:

1. Name of steel sheet pile pair number.

2. Driven pile length.

3. Pile length after cut off (if required).

4. Top of pile elevation.
The Chief Construction Manager is the Port Construction Representative of the Port of Houston, as defined in DIVISION 00 - Procurement and Contracting: Special Conditions of the Project Specifications.

F. Statements

1. Pile pulling method.

2. Material certificates:
   a. Submit for each shipment of piling; certificates identified with specific lots prior to installing piling. Identification data should include piling type, dimensions, chemical composition, mechanical properties, section properties, heat number and mill identification mark.
   b. Submit certificates and statements of conformance and acceptability for turnbuckles and ultrasonic test results.
   c. Submit mill certificates, with chemical composition and mechanical properties, and product cut-sheet data on headed anchor stud connectors.

3. Pile driving equipment: Submit descriptions of pile driving equipment to be employed in the Work to the Chief Construction Manager for approval. Descriptive information should include manufacturer’s name, model numbers, capacity, rated energy, hammer details, cushion material, helmet and templates.

G. Records: Submit Pile Driving/Installation Records:

   a. Maintain a pile driving record for steel sheet piles

   b. Indicate on the installation record installation date and times, type and size of hammer, rate of operation, total driving time, dimensions of driving helmet and cap used, blows required per foot of each foot of penetration, final driving resistance in blows for final 6 inches, pile locations, tip elevations, ground elevations, and any reheading or cutting of piles.

   c. Record any unusual pile driving problems during driving.

H. Submit noise reduction and emission monitoring program.

1.5 HANDLING AND STORAGE

A. Deliver steel sheet piles in pairs, achieved by crimping of the interlocks.

B. Handle piling using handling holes or lifting devices. Handle long length piles with multiple lifting points and care to prevent damage. Handling of epoxy coated piles shall be by sling.

C. Support piling off the ground on level blocks or racks spaced not more than 10 feet apart and not more than 2 feet from the ends. Supports between multiple lifts shall be aligned in a vertical plane.

D. Protect piling to prevent damage to coatings and to prevent corrosion prior to installation.
PART 2 PRODUCTS

2.1 STEEL SHEET PILES

A. Steel sheet piles shall be manufactured of hot-rolled steel conforming to the following:
   
   1. Pipe Piles and Connectors: ASTM A-690 or A-572, Grade 50, minimum yield strength 50,000 psi, may be applied in pairs.
   
   2. Steel Sheet Piles: ASTM A-690 or A-572, Grade 50, minimum yield strength 50,000 psi.

B. The connectors shall be continuously welded to the pipe full length on both sides, as shown on the drawings in accordance with AWS D1.1, latest edition. Interlocks of sheet piling shall be free sliding, allowing a swing angle of at least 5 degrees when threaded and maintain continuous interlocking when installed.

C. Sheet piling, including corner sections, and special fabricated sections, shall be full-length sections to the dimensions shown, or required to complete the bulkhead to the overall dimensions indicated.

D. Fabricated sections shall conform to the requirements herein and the piling manufacturer’s recommendations for fabricated sections. Fabricated corners, tees and cross pieces shall be fabricated of piling sections with a minimum thickness of ½-inch.

E. Provide piling with standard pulling holes.

F. Provide elevation reference and mark each pile to permit determination of the pile tip and top elevation.

2.2 STEEL BATTER PILES

Steel batter piles shall be in accordance with the requirements set out in the Section for Steel H Piles.

2.3 PREFABRICATED STEEL CAP

The prefabricated steel cap shall be in accordance with the requirements set out in the Section for Structural Steel Framing, unless noted otherwise.

The pipe material used for the steel cap shall meet the requirements in this specification and be compatible with the steel plate elements for welding requirements and fabrication tolerances.

The coating requirements for the steel cap shall meet the requirements in this specification.
2.4 SHOP PROTECTIVE COATING

A. Bulkhead sheet pile, king/pipe pile, and other structural steel not otherwise specified, shall be protectively coated as specified in the Section for Epoxy Coatings to the limits noted on the Drawings.

PART 3 EXECUTION

3.1 COATING OF STEEL SHEET PILING AND OTHER STEEL MEMBERS

A. General: Material coating shall be protected during handling, transportation, and final installation.

B. Touch-Up:

After the sheet piling is erected into position in the bulkhead wall, and before it is driven to its final position, the Contractor shall touch-up all holidays, scratches, abrasions, etc. with the same materials and methods used on the original coating as required by the Inspector.

Should any of such touch-up points fall below the ground or water line in final position, that pile shall remain undriven for at least 24 hours after being touched-up.

After excavation of earth from against any coated surface, all scratches or abrasions caused by driving, excavating, or other causes that are disclosed, shall be touched-up.

After welding of wales, brackets, caps, or other attachments, all damaged areas of coating that are accessible shall be cleaned and recoated.

3.2 EARTHWORK

Perform in accordance with applicable Division 31 sections. Backfill bulkhead retaining wall system as indicated, with select structural backfill material.

3.3 CUT-OFFS, SPLICES AND BUILD-UPS

All splices for steel piling shall be made with continuous butt welds to develop the full strength of the member. All the butt welds shall be complete penetration, pre-qualified welds. Provide 100% radiographic or ultrasonic examination of the welds in accordance with AWS D1.1/D1.1M. The welding shall be performed in accordance with the requirements of AWS D1.1.

After the piling has been driven to the penetration required by the Drawings, the surplus length of piling, if any, shall be cut to the Drawing grade or the grade established by the Chief Construction Manager. If the head of the piling is appreciably distorted or otherwise damaged below cutoff level, the damaged portion shall be cut off and built up to correct elevation with an undamaged section at the Contractor's expense. All cutoffs, regardless of reason for cutoff, shall be delivered to the Chief Construction Manager at the end of each day's work. When piling is furnished by the Port Authority, an allowance of one foot of extra length will be made for damage to the top.

Where pile heads are required by the Drawings, the end surfaces of the piling shall be made as smooth as practical before the pile head is welded in place. The pile head shall conform to the Drawing details.
Welding shall comply with the requirements of the American Welding Society Structural Welding Code, Serial Designation D1.1.

3.4 TOLERANCES

A. Piling shall be driven at the locations and to the depths shown on the Drawings. The piles shall be driven vertically and in correct alignment so that the top of straight walls will not deviate from a straight line more than one and one-half 1-1/2 inch in either direction after driving. In circular cofferdams, the tops of piles shall form a circle in which any diameter will not deviate from the specified diameter by more than one inch. The driven pile shall not deviate more than one-sixteenth inch per foot from the vertical.

B. All sheet piling shall be driven to within one inch of the elevation of top of pile as shown on the Drawings, or, if a cutoff is necessary, the pile may be cut off to grade with an acetylene torch within a tolerance of plus or minus 1/2-inch. In the event a pile is overdriven, a piece shall be spliced on to building the pile to the elevation called for on the Drawings. No increase in contract price will be allowed by reason of such cutting, splicing or overdriving.

C. The Contractor shall remove and replace any pile that deviated from its correct position as shown on the Drawings. If permitted tolerances result in closures or intersections that vary in dimension from those shown on the Drawings, the Contractor shall alter or provide the closure section as directed by the Chief Construction Manager at no cost to the Port Authority.

D. Piling must be driven so that the interlocks will be completely engaged. Any pile ruptured at the interlock or injured in any other way, shall be removed, the hole filled with sand, and other pile driven. Such work is to be done at the Contractor’s expense.

3.5 PROTECTION OF PILE HEADS

A structural steel driving head suitable for the type and size of pile being driven shall be used. Wood cushion blocks shall be used as necessary to prevent damage to the pile. Rope mat, belting, or other similar cushioning material may be used in addition to wood cushion blocks.

3.6 DRIVING EQUIPMENT

Pile Hammer: Use a hammer having a delivered force of energy suitable for the total weight of the pile and the character of the sub surface materials to be encountered. Operate hammer at the rates recommended by the manufacturer throughout the entire driving period. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy.

Gravity hammers, if permitted, shall weigh not less than 2,000 or more than 5,000 pounds and shall have a maximum height drop of 10 feet. Pile drivers shall be equipped with leads which are constructed in such a manner as to afford freedom of movement of the hammer and which provide adequate support to the pile during driving. The vertical axis of the leads and hammer shall coincide with the vertical axis of the pile. Free swinging leads will not be permitted, and arrangements shall be made to hold the pile firmly in the correct position by braces or templates while it is being driven. Leads must extend down to the lowest point the hammer must reach. When driving through water, the bottom of the leads must be braced to the working platform. When the pile driver is mounted on a barge, the barge shall be equipped with spuds of sufficient length to hold the barge in position during the driving operation.
3.7 PENETRATION

All piles shall be driven to the penetration shown on the Drawings. Allowance for loss of pile length due to damage of the top shall be made in ordering pile lengths.

When the pile cannot be driven to the required penetration without excessive damage, or within the aforesaid tolerances, the Chief Construction Manager shall require the Contractor to use jetting, or pilot holes, depending upon the character of the materials through which the pile is to be advanced.

3.8 JETTING

Jetting is not permitted.

3.9 PILOT HOLES

When the material to be penetrated is unsuitable for jetting, the Chief Construction Manager may permit, or direct, the use of pilot holes drilled to a depth not lower than five feet above the bottom elevation of the piles. Pilot holes may not be used without the written permission from the Chief Construction Manager, and their use shall not be grounds for any increase or decrease in the Contract price. Pilot holes shall be centered on the diagonal web of the pile and shall be at least one inch less in diameter than the depth of the sheet pile. Pilot holes shall be filled with graded gravel passing a 3/4-inch sieve after the piles are in place.

3.10 PILE DRIVING METHODS AND PROCEDURES

A. The Contractor shall be responsible for the selection of methods and procedures for driving piles and for the design of templates and bracing that will advance the piles within the tolerance required by these Specifications. The methods and procedures shall be consistent with the requirements set out in these Specifications. All piles shall be kept under close observation during driving in order that drift or other tendency toward misalignment may be detected and corrections made before misalignment become serious. When misalignments occur, the Chief Construction Manager may order the Contractor to modify his methods and rigging.

B. Pile Driving:

1. Making piling vertical during driving. Drive piles in such a manner as to prevent damage to the piles and to provide a continuous closure. Where possible, drive sheet piles with the ball end leading. If an open socket is leading, a bolt or similar object placed in the bottom of the interlock will minimize packing material into the socket and ease driving for the next.

2. Incrementally sequence driving of individual piles such that the tip of any king/pipe pile and steel sheet pile combination shall not be more than 4 feet below that of any adjacent pipe/king pile and sheet steel pile combination, nor ¼ of its length between adjacent sheet piles. When the penetration resistance exceeds five blows per inch, the tip of any pile combination shall not be more than 2 feet below that of any adjacent pile combination.

C. Templates and guides shall be used while driving all steel sheet piling. The design, arrangement, and anchoring of templates and guides shall be adequate to ensure that the
piling will be driven to the proper location, and, as otherwise required by these Specifications.

Templates:

1. Prior to driving, provide template or driving frame suitable for aligning, supporting, and maintaining bulkhead wall piling in the correct position during setting and driving. The piles shall be erected between two well-braced sets of templates (two-tier system), one at/near ground level and the other at or above mid-height of the piling. The templates shall be rigid and shall support and guide both the interior and exterior of the piling. Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support the piling until design tip elevation is achieved.

2. Templates shall not move when supporting piling. Fit templates with wood blocking to hold the piling at the design location alignment. Provide outer template straps or other restraints as necessary to prevent piling from warping or wandering from the alignment.

3. Mark template for the location of the leading edge of each piling.

D. The distance between the guide wales shall not exceed the depth of the pile plus one inch. When driving is difficult, the Chief Construction Manager may require blocking between the trough of the pile and the guide wale. The piles shall be erected in a true vertical position and shall be so maintained throughout the driving operation.

E. When the sheet piling to be driven under this Contract form an extension of an existing wall or bulkhead, driving shall start at the last existing pile and shall proceed in one direction to the far end of the wall being constructed. In constructing a new wall that does not connect with an existing bulkhead, driving may start at either end and proceed in one direction toward the other end, or may start at an intermediate point and proceed toward each end. In no case shall the driving of two portions of a bulkhead be advanced toward a common meeting point.

F. Before driving, the correct location of each pile shall be marked on the bottom template so that drift may be detected as soon as it begins. Piles shall be prevented from drifting or "walking", by pulling on the pile as it is driven, by directing the hammer blows so as to correct drift, or by other effective means. If necessary, "anchor" piles may be driven at suitable intervals and advanced ahead of intervening piles to assist in holding alignment and to prevent drift.

G. Changes in direction, except in circular cofferdams, shall be made with fabricated corners in accordance with details on the Drawings. Expansion joints shall be constructed where shown in the Drawings and in accordance with the accompanying details.

3.11 INSPECTION

A. Perform continuous inspection during pile driving. Inspect all piles for compliance with tolerance requirements. Bring any unusual problems which may occur to the attention of the Chief Construction Manager.

B. Inspection of Driven Piling:

1. Contractor shall inspect the interlocks of the portion of driven piles that extend above ground. Remove and replace piles found to be out of interlock.
2. Contractor may be required to use divers to inspect the underwater portions of sheet piling interlocks should the question of piles out of interlock below water level be raised.

C. Pulling and Redriving:
1. Contractor may be required to pull selected piles after driving to determine the condition of the underground portions of pile.
2. Contractor may be required to pull and redrive piles that do not meet specified tolerances.
3. The pile pulling method must be approved by the Chief Construction Manager.
4. Remove and replace at the Contractor’s expense any pile pulled and found to be damaged to the extent that its usefulness in the structure is impaired.
5. Redrive piles pulled and found to be in satisfactory condition.

3.12 STRUCTURAL STEEL FABRICATION AND INSTALLATION
A. Description:
1. The Contractor shall furnish, fabricate and install, all structural steel wales, caps, brackets, or other attachments shown on the Drawings.
2. The Contractor shall furnish, fabricate and install all fittings, corners and connections to the sheet piling necessary to construct the bulkhead in the location and to the alignment shown on the Drawings.
3. The Port Authority will limit the period of effectiveness of qualifications for welders, welding operators, and tackers as set out below.
   a. Certificate of Qualification submitted for a welder, welding operator, or tackers in a fabricating shop, or manufacturing plant, will be accepted provided that he has been tested by an approved testing laboratory within the preceding twelve months, and that it is shown to the satisfaction of the Chief Construction Manager that the operator has been doing satisfactory welding of the required type within the preceding three months.
   b. Certificates of qualification for a welder, welding operator, or tackers in the field, will be accepted provided that he has been tested by an approved laboratory within the preceding six months and that the operator has been doing satisfactory welding of the required type within the preceding three months.
   c. If the quality of the work of any operator is substandard, he may be required to retake qualification tests.
B. Formation of Holes:
   Except as set out hereafter, holes for bolts, rivets, and pins shall be punches, drilled, or sub-punched and drilled as called for on the Drawings, and in accordance with Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings of the American
Institute of Steel Construction; however, field holes may be made by gas burning the hole undersize all around and reaming to the proper size.

C. Coated Members:

Whenever burning, drilling, welding or other operations cause damage to coating, such damage shall be repaired by recoating in accordance with the requirements set out above for coating. Where such damage is to the back side of the piling and would require excavation of more than three feet of earth solely in order to make the damaged area accessible, such inaccessible areas need not be repaired unless otherwise ordered by the Chief Construction Manager, in which case the cost of such excavation will be borne by the Port Authority.

3.13 ANCHORAGE STRUCTURES

A. The Contractor shall construct all anchorage structures as they are shown on the Drawings.
   1. Steel bearing (raker) piles in tension or compression that are attached to wall piles through prefabricated steel caps or concrete wale cap beams.

B. All steel bearing (raker) piles shall be furnished and driven in accordance with applicable provisions of the section for Steel Pipe Piles. Steel piles shall be driven to the batter lines shown on the Drawings. The tops of piles shall not vary from planned locations by more than 1 1/2 inches in a plane through the axis of the pile that is normal to the face of the bulkhead.

3.14 DRAIN WELLS AND WEEP HOLES

Drain wells where shown on the Drawings, shall be constructed to the size and depth and at the locations, as shown on the Drawings, and shall be drilled in accordance with the applicable provision of the section for Uncased Drilled Concrete Piers, the wells shall be filled with a mixture of graded gravel and sand meeting the requirements for coarse and fine aggregates for concrete as set out in the section for Structural Concrete, well mixed in the proportions of three parts of gravel passing a 1-1/2-inch screen and two parts of sand.

Prior to filling the drain wells, install a weep hole consisting of a length of 4-inch steel pipe extending through and welded to the steel sheet piling as shown on the Drawing. The pipe is to be coated as required for steel sheet piling, its inner end to be covered with a No. 4 mesh 0.080-inch wire woven stainless steel screen bent over and securely wired to the pipe with four turns of 0.054-inch stainless steel wire attached before pipe has been coated. Damage to coating due to welding shall be repaired on the front face of bulkhead in accordance with the requirements for coating.

Horizontal drains, where called for on the Drawings, shall be constructed using the gravel and sand fill specified above, laid down on the lines and grades required by the details. The drain fill shall be compacted to a stable density.

END OF SECTION