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NAVFAC PTS-H10 (September 2022)  
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Preparing Activity: NAVFAC SUPERSEDING PTS-H10 (December 2018)  
  
PERFORMANCE TECHNICAL SPECIFICATION  
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SECTION H10  
  
WATERFRONT STRUCTURES  
09/22

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NOTE: This section is intended to be used as a guide and contains requirements that are common to many different types of facilities; however, not all requirements and equipment items will be applicable to all projects. In addition, there may be special requirements for a particular project that are not addressed at all. The RFP preparer may have to incorporate additional information to address these special requirements in this PTS and corresponding Part 3 ESR. If the RFP preparer chooses to delete elements that are not required for the project, do not change the remaining Uniformat paragraph designations (example - A102001). Uniformat designations are unique to the products they are assigned to. However, the subparagraph numerical extensions (example - 1.2 or a,b,c) of the Uniformat designations may change if subparagraphs are deleted.  
  
This guide specification is formatted utilizing Uniformat II, an industry recognized standard, ASTM E 1557. When the RFP preparer chooses to add a paragraph that does not apply to an existing building element already included in the specification, refer to the Uniformat/WBS located on the NAVFAC Design-Build Website for a listing of Uniformat II designations and definitions.  
  
NOTE: The RFP preparer may view or hide the criteria notes in this PTS section by modifying the WORD preferences for "Hidden text". To view the criteria notes, choose "File" then "Option". Click "Display" then check the "Hidden text" box under "Always show these formatting marks on the screen". In the same section, check the box for "Print hidden text" under "Printing options" to print the criteria notes.  
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NOTE: The Table of Contents is intended for navigation purposes only for the RFP writer and should not show up in the printed document.  
  
TABLE OF CONTENTS  
  
H10 GENERAL  
H10 1.1 NARRATIVE  
H10 1.2 WATERFRONT STRUCTURE DESIGN GUIDANCE  
H10 1.3 QUALITY ASSURANCE  
H10 1.4 DESIGN SUBMITTALS  
H10 1.5 CONSTRUCTION SUBMITTALS  
H1010 SUBSTRUCTURE  
H101001 PILE FOUNDATIONS  
H101001 1.1 PILES  
H101001 1.2 SHEET PILES  
H101001 1.3 CAISSONS  
H101001 1.4 COFFERDAMS  
H101001 1.5 WRAPS AND ENCASEMENTS  
H101001 1.6 OTHER PILE FOUNDATION ELEMENTS  
H101002 PILE CAPS  
H101003 QUAYS  
H101003 1.1 SHEET PILES BULKHEAD  
H101003 1.2 CONCRETE GRAVITY WALLS  
H101003 1.3 BLOCK WALLS  
H101003 1.4 CAISSONS  
H101003 1.5 CRIBS  
H101003 1.6 OTHER QUAY ELEMENTS  
H101004 RELIEVING PLATFORMS  
H101005 REVETMENTS  
H101006 SEAWALLS  
H101007 BOAT RAMPS  
H101008 CUT-OFF WALLS  
H101009 FIREWALLS AND HANGING PANELS  
H101009 1.1 FIRE WALLS  
H101009 1.2 WAVE ATTENUATION PANELS  
H101009 1.3 OTHER WALLS AND PANELS  
H101090 OTHER SUBSTRUCTURE COMPONENTS  
H1020 SUPERSTRUCTURE  
H1020 1.1 STRUCTURAL FRAME  
H1020 1.2 MAIN LATERAL-FORCE RESISTING SYSTEM  
H102001 BEAM AND GIRDERS  
H102002 COLUMNS  
H102003 UTILITY ENCLOSURES  
H102003 1.1 UTILITY VAULTS  
H102003 1.2 UTILITY TRENCHES  
H102090 OTHER SUPERSTRUCTURE ELEMENTS  
H1030 DECK  
H103001 DECK  
H103002 ON-GRADE SLAB  
H103003 DECK OVERLAY  
H103004 CURBS AND BULLRAILS  
H103005 MOORING FOUNDATIONS  
H103006 HIGH MAST LIGHTING FOUNDATIONS  
H103007 UTILITY MOUNDS  
H103008 EXPANSION JOINTS  
H103009 GUARD POSTS AND RAILING  
H103010 PAINT STRIPING  
H103010 1.1 DECK STRIPING  
H103010 1.2 CURB STRIPING  
H103090 OTHER DECK COMPONENTS  
H1040 MOORING AND BERTHING SYSTEM  
H104001 PRIMARY FENDER SYSTEM  
H104001 1.1 FENDER PILES  
H104001 1.2 FENDER FRAMING  
H104001 1.3 FENDERS  
H104001 1.4 Extruded FENDERS  
H104001 1.5 MOLDED FENDERS  
H104001 1.6 FOAM-FILLED FENDERS  
H104001 1.7 PNEUMATIC AND HYDRO-PNEUMATIC FENDERS  
H104001 1.8 CAMELS  
H104002 SECONDARY FENDER SYSTEM  
H104003 CORNER FENDER SYSTEM  
H104004 DOLPHINS  
H104005 MOORING HARDWARE  
H104005 1.1 BOLLARDS  
H104005 1.2 DOUBLE BITTS  
H104005 1.3 CLEATS  
H104005 1.4 QUICK RELEASE HOOKS  
H104005 1.5 CAPSTANS AND WINDLASSES  
H104090 OTHER MOORING AND BERTHING COMPONENTS  
H1050 APPURTENANCES  
H1050 1.1 HANDRAILS  
H1050 1.2 BROWS  
H1050 1.3 ELECTRCIAL POWER CABLE BOOMS  
H1050 1.4 FLOATS  
H1050 1.5 SAFETY LADDERS  
H1050 1.6 LIFE RINGS  
H1050 1.7 OIL CONTAINMENT BOOM AND SUPPORT ATTACHMENTS  
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**H10 GENERAL**

RFP Part 3 including the Engineering System Requirements (ESR) provide project specific requirements. The RFP Part 4, Performance Technical Sections (PTS) provide generalized technical requirements that apply to multiple facility types and include more requirements than are applicable to any one project. Therefore, only the RFP Part 4 requirements that apply to the project and further define the RFP Part 3 project specific requirements are required.

**H10 1.1 NARRATIVE**

Use this Section in conjunction with all parts of the Design Build (D/B) Request for Proposal (RFP) to determine the full requirements of this solicitation.

This Section includes the requirements for the design and construction of waterfront structure, described in ESR H10, *Waterfront Structures*, of Part 3 and as identified on the RFP drawings provided in Part 6.

**H10 1.2 WATERFRONT STRUCTURE DESIGN GUIDANCE**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*   
NOTE: This Performance Technical Specification (PTS) has been developed to utilize certain UFGS sections for prescriptive requirements. However, there may be rare occasions when additional prescriptive specifications may be identified by the Engineering Systems Requirements (ESR) to be edited by the Contractor’s Designer of Record. If other UFGS sections or standards are to be referenced in this PTS section, list those not covered by the UMRL in the following two paragraphs.  
   
If the product or system is new and not covered in the PTS, provide a new paragraph and heading. If the product or system is presently covered in the PTS but is being changed by the reference to the UFGS, edit the PTS paragraphs to eliminate redundancy or conflicts. In either case, identify the UFGS section in the products and materials (UNIFORMAT II/WBS level 4) text of the PTS as follows:  
   
"Uniformat II/WBS Number – Paragraph Number Paragraph Heading  
The Designer of Record must utilize UFGS Section Number, "Section Title" for the project specification, and submit the edited specification section as a part of the design submittal for the project."  
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

Provide the design and installation in accordance with the following references. This Performance Technical Specification (PTS) adds clarification to the fundamental requirements contained in the following Government Standards. The general requirements of this PTS Section are located in PTS Section Z10, *General Performance Technical Specification*.

**H10 1.2.1 Government Standards**

UNIFIED FACILITIES CRITERIA (UFC)

UFC 3-220-01, *Geotechnical Engineering*

UFC 3-301-01, *Structural Engineering*

UFC 4-151-10, *General Criteria for Waterfront Construction*

UFC 4-152-01, *Design: Piers And Wharves*

UFC 4-152-07, *Design: Small Craft Berthing Facilities*

UFC 4-159-03, *Design: Moorings*

UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFGS)

UFGS Section 03 01 00, *Rehabilitation of Concrete*

UFGS Section 03 31 29, *Marine Concrete with Service Life Modeling*

UFGS Section 09 97 13.26, *Coating of Steel Waterfront Structures, Zero VOC, (SZC) Splash Zone Coating*

UFGS Section 09 97 13.27, *High Performance Coating for Steel Structures*

UFGS Section 09 97 13.28, *Protection of Buried Steel Piping and Steel Bulkhead Tie Rods*

UFGS Section 31 23 00.00 20, *Excavation and Fill*

UFGS Section 31 62 13.20, *Precast/Prestressed Concrete Piles*

UFGS Section 31 62 13.24, *Concrete Cylinder Piles*

UFGS Section 32 17 23, *Pavement Markings*

UFGS Section 35 59 13.13, *Prestressed Concrete Fender Piling*

UFGS Section 35 59 13.14 20, *Polymeric Piles*

UFGS Section 35 59 13.16, *Extruded and Molded Marine Fenders*

**H10 1.2.2 General Requirements**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*   
NOTE: Add project-specific design information below. Do not include information that is readily available to the Contractor from UFC or other sources.  
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

**H10 1.2.2.1 Subsurface Soils Information and Geotechnical Report**

Any information presented in Part 6 of the RFP with regard to soil sampling and laboratory testing is for the Contractor's information only and is not guaranteed to fully represent all subsurface conditions. Contractor must perform, at his expense, such subsurface exploration, investigation, testing, and analysis as his Designer of Record deems necessary for the design and construction of the foundation system. Contractor must assemble all boring logs and present them in the design plans.

**H10 1.2.2.2 Earthwork**

The Designer of Record must utilize UFGS Section 31 23 00.00 20, *Excavation and Fill*, for the project specification.

**H10 1.2.2.3 Marine Concrete**

The Designer of Record must utilize UFGS Section 03 31 29, *Marine Concrete with Service Life Modeling*, including the use of epoxy coated rebar, for the project specification covering concrete components used in waterfront superstructure, substructure, deck and mooring and berthing systems, unless noted otherwise. The maximum water-cement ratio and minimum compressive strength must be 0.40 and 5000 psi (35 MPa) respectively.

**H10 1.2.2.4 Concrete Cover**

Concrete components submerged in water or subjected to water spray must have a minimum of 3 inches (75 mm) concrete cover over reinforcing steel or prestressing steel.

**H10 1.2.2.5 Coating of Steel Waterfront Structures**

The Designer of Record must utilize UFGS Section 09 97 13.26, *Coating of Steel Waterfront Structures, Zero VOC, (SZC) Splash Zone Coating*, for the project specification covering coating of galvanized and non-galvanized steel structure elements such as piles, sheet piles, fender piles, power booms, power mounds, mooring hardware, and other miscellaneous steel items located on the waterfront structure and exposed to water immersion, water splash and spray, high humidity or tropical environmental condition.

Coating of miscellaneous steel items located on the waterfront structure and not exposed to water immersion, water splash and spray, high humidity or tropical environmental condition can follow UFGS Section 09 97 13.27, *High Performance Coating for Steel Structures*.

**H10 1.2.2.6 Stainless Steel**

Stainless steel when used must be Type 316 or 316L.

**H10 1.2.2.7 Dewatering**

Dewatering requirements and methods must be established by the Contractor's Structural/Geotechnical Engineers, based on his subsurface exploration and investigation considering soil conditions and local subsurface waters and surface water, including rainfall. Any dewatering discharge will require a NPDES permit.

**H10 1.2.2.8 Permit and Environmental Control**

Waterfront structure work must meet the permit and environmental control requirements of Part 2 Section 01 57 19, *Temporary Environmental Controls*. Do not commence in-water construction until the required United States Army Corps of Engineers (USACOE) permits are obtained. Construction must meet the conditions stipulated in the USACOE permits.

**H10 1.2.2.9 Repair and Rehabilitation**

Repair and rehabilitation of waterfront structure, if required, must cover concrete spalls, delaminations and cracks and steel corrosion. Concrete repair and rehabilitation must follow the requirements of UFGS Section 03 01 00, *Rehabilitation of Concrete*. Perform detailed existing condition inspection during the design phase. Inspection must be performed by certified concrete technicians or structural engineers to identify and document the size and locations of cracks, spalls, delaminations, corrosion and other deteriorations on the existing structure. Underwater inspection must be performed by qualified divers with similar qualifications as the underwater inspectors used for Underwater Quality Control (UWOC) described in the "Underwater Inspection" paragraph of this PTS Section.

**H10 1.3 QUALITY ASSURANCE**

Submit qualifications, certifications, and Test Plans indicated herein 45 calendar days prior to the expected date of execution. Notify the Contracting Officer 14 calendar days prior to all testing. Submit test results within 7 calendar days of completion of testing.

The Designer of Record is responsible for approving the submittals listed below.

**H10 1.3.1 Earthwork**

Perform quality assurance for earthwork in accordance with IBC Chapter 17 and UFGS Section 31 23 00.00 20, *Excavation and Fill*. A registered Professional Engineer must perform inspections of excavations and soil/groundwater conditions throughout construction. The Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Engineer, with the concurrence of the Contractor and the Contracting Officer, must update the excavation, sheeting, and dewatering plans as construction progresses to reflect actual site conditions and submit the updated plan and a written report (with professional stamp) at least monthly informing the Contractor and the Contracting Officer of the status of the plan and an accounting of Contractor adherence to the plan; specifically addressing any present or potential problems. The Engineer must be available to meet with the Contracting Officer at any time throughout the contract duration. The Contractor bears all costs of the Engineer.

**H10 1.3.2 Piles**

Perform quality assurance for pile construction in accordance with UFC 3-220-01. Pile installation procedures and installed piles must be inspected and found to be in compliance with these specifications prior to acceptance of the work. Concrete piles, if used for the project and upon inspection are found to contain cracks completely around the piles, must be replaced at no additional cost to the Government. Refer to the "Underwater Inspection" paragraph of this PTS Section for special inspection requirements.

Install indicator test piles as directed by the Contractor's Structural/Geotechnical Engineer. The load capacity of piles, as determined by pile driving formulae or geotechnical analysis, must be verified by load tests or by dynamic pile analyzer methods. Test pile installation procedures must be as directed by the Contractor's Structural/Geotechnical Engineer. Submit results of the indicator test pile program and final pile installation criteria to the Contracting Officer prior to installation of the production piles.

**H10 1.3.3 Underwater Inspection**

Contractor's Underwater Quality Control (UWQC) Team must perform underwater surveillance and inspection of all under water construction. The UWQC lead diver must be thoroughly familiar with the design plans and specifications to sufficiently understand the engineering aspects of the underwater construction and to be able to recognize and document potential problem areas such as improperly constructed or defective work. Prepare and submit a report including photographs and/or videos with the QC report after each dive. Include in the report a description of all improperly constructed or defective areas and conditions. Underwater surveillance and inspection must be performed after substructure installation and prior to superstructure and deck construction, after project construction is completed, and after all repairs to improperly constructed or defective areas and conditions have been completed. In addition to underwater conditions, survey and inspect above water, below deck conditions.

Repair and correct all improperly constructed or defective areas and conditions identified in the report at no additional cost to the Government. Prior to performing any work, submit to the Contracting Officer for approval the repair or corrective actions to be taken including plans and specifications.

**H10 1.3.4 Marine Concrete**

Conduct Quality Assurance activities for Marine Concrete in accordance with the UFGS Section 03 31 29, *Marine Concrete with Service Life Modeling*.

If project is located outside of the mainland U.S. and Hawaii, Contractor is advised that the Chloride Ion Test required in accordance with UFGS Section 03 31 29, *Marine Concrete with Service Life Modeling*, is a long lead item (the test will take at least 60 days) and it may be necessary to have the test done in the U.S mainland.

**H10 1.4 DESIGN SUBMITTALS**

Submit design submittals in accordance with PTS Section Z10, *General Performance Technical Specification*, Part 2 Section 01 33 10.05 20, *Design Submittal Procedures*, FC 1-300-09N, *Navy and Marine Corps Design Procedures*, UFC 3-301-01, *Structural Engineering*, and UFC 4-152-01, *Design: Piers and Wharves*.

Additional design submittals for waterfront structure construction are as follows:

Concept Design Submittal:

Conceptual substructure, superstructure and deck layout and structural framing plans

Concept substructure and slope and wave protection layout plans

Concept design report to describe the system and justification of the selections. Include in the submittal a detailed description including sketches of all proposed in-water construction adequate for the USACOE permit application.

Design Development Submittal:

Existing condition inspection report

Preliminary substructure, superstructure and deck layout and structural framing plans with substructure locations

Preliminary substructure and slope and wave protection plans with locations of facilities and type of construction finalized

Preliminary substructure sections and details with substructure sizes finalized

Preliminary slope and wave protection details

Preliminary calculations to demonstrate that the basis framing and sizing of the major substructure and superstructure elements meet the performance requirements specified in the RFP.

Preliminary geotechnical report(s) including recommendation on test pile program

100 Percent and Final Design Submittal:

Final plans, sections and details

Final design calculations

Final geotechnical report(s)

**H10 1.5 CONSTRUCTION SUBMITTALS**

The general requirements of this PTS Section are located in PTS Section Z10, *General Performance Technical Specification*. Submit construction submittals in accordance with Part 2 Section 01 33 00.05 20, *Construction Submittal Procedures*.

In addition to the Government Approval items listed in Part 2 Section 01 33 00.05 20, submit the following waterfront structure related critical items for Government Approval:

Marine Concrete Mix Design

Pile Load Test Reports

Fender Product Data

In additional to the Government Surveillance items listed in Part 2 Section 01 33 00.05 20, submit the following waterfront structure related items for Government Surveillance:

Piling Shop Drawings

Fender Piles shop Drawings

Fender Panels Shop Drawings

Mooring Hardware Shop Drawings

**H1010 SUBSTRUCTURE**

**H101001 PILE FOUNDATIONS**

Provide foundations in compliance with the requirements of this RFP and in accordance with the recommendations of the Contractor's Geotechnical/ Structural Engineers.

**H101001 1.1 PILES**

**H101001 1.1.1 Restrictions**

Restrictions are listed in the "Substructure" paragraph in ESR H10, *Waterfront Structures*, of Part 3.

**H101001 1.1.2 Driving Equipment**

Install piles to the required tip elevation or capacity with a pile hammer of sufficient weight and energy to suitably drive the piles without damage. Operate hammer at manufacturer's recommended speed, and drive piles without interruption using the appropriate equipment as recommended by the Contractor's Geotechnical Engineer.

a. Drive production piles with the same hammer, cap block and cushion materials, and use the same operating conditions, including pre-drilling (if allowed within this RFP), as indicator test piles.

b. Pile driving equipment mustl match the equipment assumptions on which the pile driving formulae used to determine blow counts are based.

**H101001 1.1.3 Installation Tolerances**

a. Locate pile butts not more than 4 in (100 mm) from the location indicated at cutoff elevation. Manipulation of the piles is not permitted. In addition to the stated tolerances, the clear distance between the heads of piles and the edges of pile caps must be determined by the Contractor’s Structural Engineer but no less than a minimum of 5 in (125 mm).

b. Locate top of sheet piles at cutoff elevation within 1/2 inch (12 mm) horizontally and 2 inch (50 mm) vertical of the location indicated. Manipulation of the piles is not permitted.

c. A variation of not more than 2 percent from the vertical for plumb piles, or not more than 4 percent from the required angle for batter piles will be permitted.

**H101001 1.1.4 Mislocated and Damaged Piles**

Remove and replace with new piles those piles that are cracked, damaged, mislocated, or installed out of alignment tolerance or provide additional piles, installed as directed by the Contractor's Structural/Geotechnical Engineer, at no additional cost to the Government.

**H101001 1.1.5 Pile Driver Analyzer**

The dynamic wave equation method of analysis, pile driver analyzer, must be used to validate pile and pile hammer compatibility, establish pile driving criteria, and establish terminal penetration resistance.

**H101001 1.1.6 Pile Spacing**

For cast-in-place concrete or augercast piles, provide adequate distance, as determined by the Contractor's Structural / Geotechnical Engineer, between freshly placed concrete and other pile installation operations to avoid damage to concrete.

**H101001 1.1.7 Prestressed Concrete Piling**

The Designer of Record must utilize UFGS Section 31 62 13.20, *Precast/Prestressed Concrete Piles*, or 31 62 13.24, *Concrete Cylinder Piles*, for the project specification.

**H101001 1.1.8 Reinforced Concrete Drilled Shaft**

Perform concreting of reinforced concrete drill shaft with water inside the shaft using the tremie method of concrete placement. Disposition of the displaced water must meet the environmental control requirements of Part 2 Section 01 57 19, *Temporary Environmental Controls*. For concrete placed under water, non-destructive test method must be specified to verify the integrity of the concrete.

**H101001 1.1.9 Steel Pipe Piles**

Steel pipe pile with spiral-butt or spiral-lap seams is not allowed.

**H101001 1.1.10 Coating for Steel Piles**

For steel piles in contact with water, provide cathodic protection of the piles meeting the requirements of the "Cathodic Protection System" paragraph in PTS Section G40, *Site Electrical Utilities*. In addition, apply protective coating conforming to SSPC PS 11.01 and UFGS Section 09 97 13.26, *Coating of Steel Waterfront Structures, Zero VOC, (SZC) Splash Zone Coating*, on all surfaces of the steel piles exposed to water for corrosion protection. Handle treated or coated piles so as to protect the treatment or the coating. Repair damage or defects to treatment or coating.

**H101001 1.2 SHEET PILES**

Sheet pile can be used to provide vertical support to waterfront structure and must consist of either steel, precast reinforced concrete or fiberglass reinforced plastic construction. Refer to the "Sheet Pile Bulkhead" paragraph of this PTS Section for additional, including corrosion protection, requirements.

**H101001 1.3 CAISSONS**

Caisson can be used to provide vertical support to waterfront structure. Refer to the "Caissons" paragraph under "Quays" paragraph in this PTS Section for additional requirements.

**H101001 1.4 COFFERDAMS**

Cofferdam can be used to provide vertical support to waterfront structure and must be constructed of steel sheet pile cells. Refer to the "Sheet Pile Bulkhead" paragraph in this PTS Section for additional requirements.

**H101001 1.5 WRAPS AND ENCASEMENTS**

Existing piles can be repaired by wrapping or encasing with non-corrosive material including but not limited to fiberglass reinforced plastic and reinforced concrete.

**H101001 1.6 OTHER PILE FOUNDATION ELEMENTS**

Not used.

**H101002 PILE CAPS**

Pile caps that are in contact with water (including ground water), and water spray must meet the requirements of the "Marine Concrete" paragraph, including the use of epoxy coated rebar, in this PTS Section. Use of non-marine concrete and non-epoxy coated rebar in buried pile caps placed above ground water may be considered. Concrete cover on reinforcing steel, steel piling and other embedded steel items must be at least 3 inches (75 mm).

**H101003 QUAYS**

Guidance on seismic performance requirement for tie-back sheet pile bulkheads and gravity retaining structures (including caissons) located in high seismic areas can be found in the Criteria Section of NFESC Technical Report TR-3103-SHR, *Seismic Criteria for California Marina Oil Terminals*(referenced from UFC 4-152-01).

**H101003 1.1 SHEET PILES BULKHEAD**

Sheet pile bulkhead can be used as a solid retaining structure and can be either of steel, reinforced precast concrete or fiberglass reinforced plastic construction with tie-back anchors or other means of anchors. Design and construct backfill behind the bulkhead to minimize its liquefaction potential. Corrosion protection of steel sheet pile must be in accordance with the requirements of the "Coating of Steel Piles" paragraph in this PTS Section. Top of sheet piles must be encased in reinforced concrete pile caps (refer to the "Pile Caps" paragraph in this PTS Section). Scour protection at the mud-line must be considered in the design of sheet pile bulkhead.

**H101003 1.1.1 Tie-Back Anchors**

Design of the bulkhead and its tie-back anchors must consider liquefaction potential of the site and the backfill behind the bulkhead. For tie-back anchors using piles and piles caps, refer to requirements in the "Piles" and "Pile Caps" paragraphs in this PTS Section.

**H101003 1.1.2 Tie Rods**

Provide corrosion protection for steel tie-rods. Means of corrosion protection must include cathodic protection meeting the requirements of "Cathodic Protection System" paragraph in PTS Section G40, *Site Electrical Utilities*, and either coated or tape-wrapped conforming to UFGS Section 09 97 13.28, *Protection of Buried Steel Piping and Steel Bulkhead Tie Rods*.

**H101003 1.2 CONCRETE GRAVITY WALLS**

Concrete gravity walls can be used as a solid retaining structure and must consist of cast-in-place or precast concrete block construction. Design and construct backfill behind the gravity walls to minimize its liquefaction potential. Scour protection at the mud-line must be considered in the gravity wall design.

**H101003 1.3 BLOCK WALLS**

Block walls constructed of masonry or stone blocks must be reinforced with steel reinforcing bar and can be used for minor quay wall construction. Block walls are not allowed for use in retaining the embankment in the primary wharf or pier structure.

**H101003 1.4 CAISSONS**

Precast reinforced concrete caissons can be used as a solid retaining structure. Design and construct backfill behind the caissons to minimize its liquefaction potential. Scour protection at the mud-line must be considered in the caisson design.

**H101003 1.5 CRIBS**

Crib wall of precast reinforced concrete units can be used for minor quay wall construction and cannot be used to retain embankment in the primary wharf or pier structure. Crib wall using steel units is not allowed.

**H101003 1.6 OTHER QUAY ELEMENTS**

Not used.

**H101004 RELIEVING PLATFORMS**

Relieving platform can be used in conjunction with a sheet pile bulkhead (with or without tie-back anchors) to reduce the lateral load on the sheet pile created by heavy surcharge load. Relieving platform consists of the following components: piles, sheet pile, pile caps, deck and fill. Requirements of these components are provided under the "Piles", "Sheet Piles", "Pile Caps" and "Deck" of this PTS Section.

**H101005 REVETMENTS**

Revetment can be used to retain the embankment either along the waterfront or upland to the pile-supported wharf or pier. Revetments can be constructed of rock dike or granular fill material. Refer to Section H30, *Coastal Protection*, for additional requirements. Design of the revetment must consider liquefaction potential of the site. Guidance on seismic performance requirements of revetment in high seismic areas can be found in the Criteria Section of NFESC Technical Report TR-3103-SHR, *Seismic Criteria for California Marina Oil Terminals*(referenced from UFC 4-152-01). Provide a cut-off wall (curtain wall) at the interface between the pile-supported wharf/pier and the upland area (refer to the "Cut-Off Wall" paragraph in this PTS Section).

**H101006 SEAWALLS**

Design seawall to retain the soil behind the wall and to protect the waterfront from wave erosion. Seawall can be constructed to retain fill above a caisson, cofferdam, revetment, concrete gravity wall or natural ground and must be of reinforced concrete construction. Scour protection at the base of the wall must be considered in the seawall design.

**H101007 BOAT RAMPS**

Design boat ramp to accommodate the launching of the specified boats and construct utilizing sheet pile or reinforced concrete walls and reinforced concrete slab.

**H101008 CUT-OFF WALLS**

Cut-off walls or curtain walls must be constructed at the interface between the wharf/pier deck and the backland and must be designed to retain the land side soil without loss of material. Cut-off-wall can be either of reinforced concrete or steel/concrete sheet pile construction.

**H101009 FIREWALLS AND HANGING PANELS**

**H101009 1.1 FIRE WALLS**

Provide fire walls for timber wharf/pier.

**H101009 1.2 WAVE ATTENUATION PANELS**

For site with high waves, pile supported wharf/pier must be designed for the uplift wave forces. Wave attenuation panels can be installed to mitigate the wave impact to the wharf/pier structure.

Design life of the wave attenuation panels must be the same as the primary wharf/pier structure.

**H101009 1.3 OTHER WALLS AND PANELS**

Not used.

**H101090 OTHER SUBSTRUCTURE COMPONENTS**

Not used.

**H1020 SUPERSTRUCTURE**

**H1020 1.1 STRUCTURAL FRAME**

For pile supported waterfront structures, the deck must be supported on a lateral load resisting structural frame.

Structural frame elements of pile supported waterfront structures include piling, columns, girders, beams and deck slab. No exposed steel deck framing is allowed.

**H1020 1.2 MAIN LATERAL-FORCE RESISTING SYSTEM**

Any main lateral-force resisting system meeting the requirements of this Section may be used.

**H102001 BEAM AND GIRDERS**

For single level, or the lower level of a double level wharf/pier, beams and girders can be the same as the pile caps. Steel beam and girder must be encased in non-corrosive material such as reinforced concrete, and fiberglass reinforced plastic. The deck must be integrated with and composite to the beam and girder system. Beams and girders can be embedded into the deck slab for wharf/pier with thick deck. Refer to the "Deck" paragraph of this PTS Section for additional requirements.

**H102002 COLUMNS**

For single level wharf/pier, the supporting piles can be the same as the columns. For double level wharf/pier, the upper level can be supported on columns non-continuous from the lower lever columns/piles. Steel columns must be encased in non-corrosive material such as reinforced concrete, and fiberglass reinforced plastic.

**H102003 UTILITY ENCLOSURES**

**H102003 1.1 UTILITY VAULTS**

Provide electrical pits/vaults under electrical power outlet assemblies and for above-deck substations and provide electrical manholes and handholes as required to meet the functional requirements of the "Electrical Utilities" paragraph in PTS Section H50, *Waterfront Utilities*. Use of below-deck substations/transformers (housed in a vault) is discouraged and its use requires special approval as specified in UFC 4-150-02.

Pits, vaults, manholes and handholes must be constructed of reinforced concrete with water proof joints and seals to prevent sea and ground water infiltration. Manhole and handhole covers must have sealed joints to preclude runoff and deck surface spills from entering the cavities. These covers must be of concrete or steel construction and be designed for all waterfront structure live load. Manhole and handhole covers must have lifting devices or means of lifting to facilitate removal of the covers. Provisions must be made to drain any water accumulation inside the pits.

Concrete pits, vaults, manholes and handholes integrated with the pile supported deck must meet the requirements of the "Marine Concrete" paragraph in this PTS Section. Use of non-marine concrete in manholes and handholes buried in soil and not integrated with the deck concrete can be used.

All exposed steel must be protected from corrosion.

**H102003 1.2 UTILITY TRENCHES**

Provide utility trenches and covers as required to meet the functional requirements of the "Civil/Mechanical Utilities" paragraph in PTS Section H50, *Waterfront Utilities*.

Trenches must be constructed of reinforced concrete with water proof joints and seals to prevent sea and ground water infiltration. Trench covers, except at location of the utility stations, must have sealed joints to preclude runoff and deck surface spills from entering the trench. Trench covers must be of reinforced concrete or steel construction and be designed for all waterfront structure live loads. Trench covers must have lifting devices or means of lifting to facilitate removal of the covers. Provisions must be made to drain any water accumulation inside the trenches.

Concrete utility trench integrated with the pile supported deck must meet the requirements of the "Marine Concrete" paragraph in this PTS Section. Use of non-marine concrete in utility trenches buried in soil and not integrated with the deck concrete can be used.

All exposed steel components must be protected from corrosion.

**H102090 OTHER SUPERSTRUCTURE ELEMENTS**

Not used.

**H1030 DECK**

**H103001 DECK**

For open type of wharf/pier where the deck is supported on piles, waterfront structure deck must be integrated with the framing system (beams, girders and columns system) meeting the requirements of the "Superstructure" paragraph in this PTS section. This elevated deck must be of reinforced concrete construction meeting the requirements of the "Marine Concrete" paragraph in this PTS Section.

Electrical and communication conductors must be contained in conduits embedded in the elevated deck, contained in concrete jacket below the deck, or supported by a raceway system inside an enclosure such as a covered utility trench/tunnel. Thickness of wharf concrete deck element must be as required to adequately provide for size, number and concentration of conduit. Refer to the "Electrical Utilities" paragraph in PTS Section H50, *Waterfront Utilities*, for additional requirements.

The following systems are not allowed this project: non-composite or composite concrete slabs on steel form deck, precast concrete soffit slabs without composite cast-in-place concrete overlay, wood deck on concrete, wood, or steel framing, and steel deck on concrete, wood or steel framing.

Elevated deck on wharf/pier must be sloped to drain to the harbor (where allowed by local resource agencies) or to collection (where required by local resource agencies).

**H103002 ON-GRADE SLAB**

For wharf/pier deck supported on grade, provide Portland cement concrete pavement, asphalt concrete pavement, or structural reinforced concrete slab as required to meet the specified service conditions and loading in accordance with the requirements of this PTS Section, PTS Section G20 (for pavement design) and other portions of this RFP.

On-grade slab or pavement on wharf/pier must be sloped to drain to the harbor (where allowed by local resource agencies) or to collection (where required by local resource agencies).

**H103003 DECK OVERLAY**

Concrete overlay placed on precast concrete soffit slabs must consist of composite reinforced concrete construction with reinforcing ties or stirrups connecting the overlay and precast slabs.

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NOTE: Add overlay requirements for repair project.  
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**H103004 CURBS AND BULLRAILS**

Provide curbs and bullrails meeting the requirements of Paragraph 4-7.3 in UFC 4-152-01 along the waterside edges of wharf/pier. Curbs and bullrails must consist of reinforced concrete construction meeting the requirements of the "Marine Concrete" paragraph in this PTS Section.

**H103005 MOORING FOUNDATIONS**

Provide foundation for mooring hardware such as bollards, double bitts and cleats. The mooring hardware foundations must be adequate to resist the rated capacity of the hardware. Mooring hardware foundations on open wharf/pier must be anchored into the deck and support framing. Mooring hardware foundations on-grade must consist of reinforced concrete construction supported on piles if recommended by the Contractor's Structural/Geotechnical Engineers. Fully embedded anchor bolts must be galvanized. Anchor bolts with exposed ends must be stainless steel.

**H103006 HIGH MAST LIGHTING FOUNDATIONS**

Provide foundation for high mast light pole or regular light poles. Light pole foundation design must meet the requirements of IBC. Light pole foundations on open wharf/pier must be anchored into the deck and support frame. Light pole foundations on grade must consist of reinforced concrete construction supported on piles if recommended by the Contractor's Structural/Geotechnical Engineers. Fully embedded anchor bolts must be galvanized. Anchor bolts with exposed ends must be stainless steel.

**H103007 UTILITY MOUNDS**

Electrical outlet assemblies and other electrical utility components must be housed inside a power mound. Construct the power mound enclosure of the concrete or steel as specified in the "Deck" paragraph in ESR H10, *Waterfront Structures*, of Part 3. Design power mound to be waterproof and to withstand the wind and wave loads that exist at the waterfront.

**H103008 EXPANSION JOINTS**

Expansion joint must be armored with steel as specified in the "Deck" paragraph in ESR H10, *Waterfront Structures*, of Part 3. Differential settlement across the joint must be less than 1/8-inch (3 mm).

**H103009 GUARD POSTS AND RAILING**

Provide guard posts to protect deck components including, but not limited to, light poles, telecommunication stations, life ring stations, and similar components from damage by equipment and vehicle moving on the wharf/pier. Provide railing for personnel protection. Guard posts and railing must consist of coated galvanized steel construction.

Construct pipe railing over utility risers to protect the risers from snagging of mooring lines. This pipe railing must be constructed of steel piping as specified in the "Pipe Guardrail" paragraph in PTS Section H50, *Waterfront Utilities*, and the "Deck" paragraph in ESR H10, *Waterfront Structures*.

**H103010 PAINT STRIPING**

Paint striping must follow the requirements of UFGS Section 32 17 23, *Pavement Markings*. Color to be determined by the Contractor's Designer-of-Record.

**H103010 1.1 DECK STRIPING**

Provide striping on the wharf/pier deck. Determine striping requirements based on safety considerations and to identify different operational areas. Minimum striping requirements are shown on the RFP drawings provided in Part 6.

**H103010 1.2 CURB STRIPING**

Paint new station marks on curb and bullrail along waterfront of wharf/pier at spacing of approximately every 25 feet (7.5 meters).

**H103090 OTHER DECK COMPONENTS**

Not used.

**H1040 MOORING AND BERTHING SYSTEM**

**H104001 PRIMARY FENDER SYSTEM**

**H104001 1.1 FENDER PILES**

Fender piles used in the primary fender system must be closely spaced to provide adequate support to the fenders, or camels. Fender piles used in secondary fender system must have maximum spacing of 10 feet (3 m).

Fender pile blockings and chocks must consist of plastic timber construction. Connecting hardware including but not limited to nuts, bolts, washers, brackets and pile collars for the fender pile system must consist of 316 or 316L stainless steel or galvanized steel construction. Provide UHMW polyethylene rubbing strips (secured by stainless steel fasteners) on the front face of each fender pile. For steel fender piles, if used, provide cathodic protection meeting the requirements of the "Cathodic Projection System" paragraph in PTS Section G40, *Site Electrical Utilities*, and apply protective coating conforming to SSPC PS 11.01 and UFGS Section 09 97 13.26, *Coating of Steel Waterfront Structures, Zero VOC, (SZC) Splash Zone Coating*.

Timber fender piles are not allowed.

**H104001 1.2 FENDER FRAMING**

Fender framing or panels may be required to support the fender or fender pile clusters. The framing can be of either stainless steel or coated and cathodically protected steel construction. The fender panels must consist of concrete or coated and cathodically protected steel construction.

**H104001 1.3 FENDERS**

Provide support framings or backing panels suitable for the type of fender used. Refer to the "Fender Framing" paragraph in this PTS Section for additional requirements.

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For project with Government furnished fenders, provide the fender information, details in Part 6  
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**H104001 1.4 EXTRUDED FENDERS**

Provide extruded fenders meeting the "extruded fenders" related requirements in UFGS Section 35 59 13.16, *Extruded and Molded Marine Fenders*.

**H104001 1.5 MOLDED FENDERS**

Provide molded fenders meeting the "molded fenders" related requirements in UFGS Section 35 59 13.16, *Extruded and Molded Marine Fenders*.

**H104001 1.6 FOAM-FILLED FENDERS**

Provide foam-filled fenders meeting the "foam-filled fenders" related requirements in UFGS Section 35 59 13.16, *Extruded and Molded Marine Fenders*.

**H104001 1.7 PNEUMATIC AND HYDRO-PNEUMATIC FENDERS**

Provide pneumatic and hydro-pneumatic fenders meeting the "pneumatic and hydro-pneumatic fender" related requirements in UFGS Section 35 59 13.16, *Extruded and Molded Marine Fenders*.

**H104001 1.8 CAMELS**

Design camels in accordance with the guidance in Paragraph entitled "Camel Designs" of UFC 4-152-01.

**H104002 SECONDARY FENDER SYSTEM**

Provide secondary fender system between the primary fenders along the wharf/pier waterfront to protect wharf/pier from accidental contact with ships or routine berthing of barges and small crafts.

Refer to the "Fender Piles" and "Fender Framing" paragraphs in this PTS Section for requirements of fender piles used in secondary fender system.

**H104003 CORNER FENDER SYSTEM**

Provide corner fender system at all corners of wharf/pier for accidental contact with ships or routine contact with tug boats. Refer to the "Fender Piles" and "Fender Framing" paragraphs in this PTS Section for additional requirements.

**H104004 DOLPHINS**

Breasting dolphin or mooring dolphins, if used must meet the applicable requirements of the "Substructures", "Superstructure", and "Deck" paragraphs in this PTS Section.

**H104005 MOORING HARDWARE**

**H104005 1.1 BOLLARDS**

**H104005 1.2 DOUBLE BITTS**

**H104005 1.3 CLEATS**

**H104005 1.4 QUICK RELEASE HOOKS**

Not used.

**H104005 1.5 CAPSTANS AND WINDLASSES**

Not used.

**H104090 OTHER MOORING AND BERTHING COMPONENTS**

Not used.

**H1050 APPURTENANCES**

**H1050 1.1 HANDRAILS**

**H1050 1.2 BROWS**

Design brows in accordance with the guidance provided in Paragraph titled "Brow or Gangway" of UFC 4-152-01.

**H1050 1.3 ELECTRICAL POWER CABLE BOOMS**

For requirements for electrical power cable booms, refer to the "Electrical Power Cable Booms for Berthing of Submarine" paragraph in PTS Section H50, *Waterfront Utilities*.

**H1050 1.4 FLOATS**

Design landing floats in accordance with the guidance provided in Paragraph titled "Landing Float" of UFC 4-152-01.

**H1050 1.5 SAFETY LADDERS**

Provide safety ladders along the wharf/pier waterfront. Safety ladders must consist of Type 316 L stainless steel or fiberglass reinforced plastic construction and must be spaced no more than 200 feet (60 meters). The bottom of the ladders must extend at least 2 feet (600 mm) below the MLLW. Member size for connections must be 3/8-inch (10 mm) thick minimum. Design ladder for 300 pounds (1.33 kN) rated capacity minimum and a minimum of 250 pounds (1.11 kN) lateral load applied anywhere on the ladder. In all cases, the ladder must meet OSHA requirements.

**H1050 1.6 LIFE RINGS**

Provide life rings with support stands and 90 feet (27 meters) rope minimum, spaced no more than 150 feet (45 meters) along the wharf waterfront. The support stand must consist of stainless steel construction.

**H1050 1.7 OIL CONTAINMENT BOOM AND SUPPORT ATTACHMENTS**

-- End of Section --