SAN FRANCISCO BAY AREA WATER EMERGENCY TRANSPORTATION AUTHORITY

San Francisco Bay Ferry
A SERVICE OF WETA

REQUEST FOR PROPOSALS

VALLEJO FERRY TERMINAL RECONFIGURATION PROJECT



VOLUME 2

TECHNICAL SPECIFICATIONS

RFP 25-053

DIVISIONS 02 - 35

SEPTEMBER 28, 2026

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SECTION 02 16 00

SHORING AND TRENCH SAFETY

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Shoring required for general safety, worker protection, and protection of adjacent property from the hazards of caving ground.

B. Shoring for trench excavations.

C. Shoring for structural excavations.

D. Shoring for work pits.

E. Design-Builder's responsibilities.

F. Design-Builder's trench safety plan.

G. Design-Builder's supervisor.

1.2 DESIGN-BUILDER'S RESPONSIBILITIES FOR SAFETY

A. The Design-Builder shall be solely and completely responsible for conditions of the job site, including safety of all persons (including employees) and property during performance of the work. This requirement shall apply continuously and not be limited to normal working hours.

B. Safety provisions shall conform to U.S. Department of Labor (OSHA), the California Occupational Safety and Health Act, and all other applicable Federal, State, county, and local laws, ordinances, codes, the requirements set forth below, and any regulations that may be detailed in other parts of these Specifications.

C. Design-Builder shall follow regulations of Part 1926 of 29 CFR, including latest revisions. This regulation governs excavations, trenching and protective systems, sloping, benching, wood, and aluminum shoring for various types of soils, and depths of excavations.

D. Where any cited requirements are in conflict, the more stringent requirement shall be followed.

E. The services of WETA, the WETA's Representative or design consultants, or any other Public Agency Representative in conducting construction review of the Design-Builder’s performance is not intended to include review of the adequacy of the

Design-Builder's work methods, equipment, bracing or scaffolding or safety measures, in, or near the construction site, and shall not be construed as supervision of the actual construction nor make WETA, WETA's Representative or design consultants, or any Public Agency Representative responsible for providing a safe place for the performance of the work by the Design-Builder, Subcontractors or suppliers; or for access, visits, use work, travel or occupancy by any person.

F. WETA's Representative's or any design consultant's review of the Design-Builder's performance is not intended to include a review or approval of the adequacy of the Design-Builder's safety supervisor, the safety program or any safety measures taken in, on or near the construction site.

G. WETA's Representative will review the safety related submittals of the Design-Builder's to verify the general scope of the work, to determine that appropriate professional services are used and to determine the construction techniques proposed for use. This review shall not in any way be construed to relieve the Design-Builder from sole responsibility for the design and safety of such shoring.

H. The Design-Builder shall carefully instruct all personnel working in suspected hazardous work areas as to potential dangers and shall provide such necessary safety equipment and instruction as is necessary to prevent injury to personnel and damage to property. Special care shall be exercised relative to electrical work, work involving excavation and in pump sump work.

I. All work and materials shall be in strict accordance with all applicable State, Federal and local laws, rules, regulations and codes.

J. Nothing in the Contract is to be construed to permit work not conforming to governing law. When Contract Documents differ from governing law, the Design-Builder shall furnish and install the higher standards called for without extra charge. All equipment furnished shall be grounded and provided with guards and protection as required by safety codes. Where vapor-tight or explosion-proof electrical installation is required by law, this shall be provided.

K. Shoring and Trench Safety Plan - Attention is directed to Section 832 of the Civil Code of the State of California relating to lateral and subjacent support, and the Design-Builder shall comply with this law. The submittal of this Plan to WETA's Representative does not constitute WETA's Representative's approval of such Plan.

L. In accordance with Section 6705 of the State Labor Code, the Design-Builder shall submit to WETA's Representative specific plans to show details of provisions for worker protection from caving ground. Not less than fourteen (14) days before beginning excavation for any trench or trenches five feet (5') or more in depth required under this Contract, the Design-Builder shall furnish to WETA's Representative working drawings of his trench safety plan. The trench safety plan working drawing shall be detailed plans showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground. If such plan varies from the shoring system standards established by the Construction Safety Orders of the California Department of Industrial Relations or the Federal Safety and Health Regulations for Construction of the Occupational Safety and Health Administration, Department of Labor, the plan shall be prepared by a registered civil or structural engineer. The Design-Builder shall provide qualified supervision as required by applicable laws, regulations and the Contract Documents. In no event shall the Design-Builder use a shoring, sloping or protective system less

than that required by said Construction Safety Orders, or less effective than that required by said Federal Safety and Health Regulations for Construction. Submission of this plan in no way relieves the Design-Builder from the requirements to maintain safety in all operations performed by him or his Subcontractors.

M. Suspected Contaminated Materials: Manage soil and groundwater as specified in Section 02 12 00 Contaminated Materials Handling and Disposal and site specific Work Plan.

N. The Design-Builder shall have in place and implemented an Injury/Illness Prevention Program (IIPP) in accordance with SB-198. The IIPP, Hazardous Communication Policy (along with copies of the Safety Data Sheets (SDS) shall be immediately available to the District Manager upon written or verbal request. Neither the District nor the District Manager will be responsible for reviewing these policies for their compliance with Federal, State and local laws, ordinances and codes and to the rules and regulations established by the California Division of Industry Safety.

1.3 PERMIT

A. For trenches or excavations of depth five feet or deeper, the Design-Builder shall obtain from the State Division of Industrial Safety a permit for such excavation; submit a copy of the permit to WETA's Representative, prior to initiating any work requiring said permit. For purposes of such permit, the Design-Builder shall assume, unless determined by the Design-Builder otherwise, that all laterals are at some point within the area of excavation five feet (5’) or deeper.

1.4 SAFETY ORDERS

A. The Design-Builder shall have at the work site, copies or suitable extracts of the Construction Safety Orders of Cal-OSHA, and Part 1926 of 29 CFR, subpart P.

B. All work shall comply with the provisions of these and all other applicable laws, ordinances and regulations.

1.5 DESIGN-BUILDER'S SUPERVISOR

A. The Design-Builder shall appoint a qualified supervisory employee who shall be on-site full time during the work and shall be responsible to determine the sloping or shoring system which shall be used depending on local soil type, water table, stratification, depth, etc.

B. This supervisor shall have a minimum of three (3) years’ experience in the directing of such excavation and shoring work. A resume of this experience shall be provided at the Pre-construction Meeting.

C. This supervisor shall have a minimum of three (3) years’ experience in the directing of such excavation and shoring work. A resume of this experience shall be provided at the Pre-construction Meeting.

D. The Design-Builders Supervisor shall meet the requirements for a “competent” person as described in Sections 1504(a) and 1541(k) (1) of the Cal-OSHA excavation regulations.

1. As such, the Design-Builder assures that this competent person has:

a. The ability to recognize all possible hazards associated with excavation work and to test for hazardous atmospheres.
b. The knowledge of the current safety orders pertaining to excavation and trenching.
c. The ability to analyze and classify soils.
d. Knowledge of the design and use of protective systems.
e. The authority and ability to take prompt correct action when conditions change.

2. Furthermore, the Design-Builder assures that this competent person shall satisfactorily fill their responsibilities to:
   a. Conduct inspections of the excavations adjacent areas, and protective systems before the start of work; as needed throughout the shift; and daily for potential cave-ins, failures, hazardous atmospheres, or other hazards.
   b. Take prompt, corrective action or remove employees from the hazard.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 02 40 00

MARINE DEMOLITION

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this section consists of demolition and removal of existing all materials as needed to allow for construction of new ferry terminal.

B. Demolition and disposal shall include, but not be limited to:

1. Steel float
2. Steel float anchor piles
3. Gangway and support piles
4. Pile supported concrete dolphin
5. Entrance gate
6. Timber pile clusters/dolphins
7. Temporary gangway landing dolphin
8. Removal of general debris from site

1.2 SUBMITTALS

A. Submittals shall follow the requirements of Section 01 30 00 – Administrative Requirements.

B. Submit proposed demolition, removal and reinstallation procedures to WETA's Representative for approval before work is started. Procedures shall provide a detailed description of methods and equipment used for each operation, detailed sequence of operations and disposal methods and locations.

1.3 REQUIREMENTS

A. The work includes demolition or removal of all materials indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Design-Builder and shall be removed from the limits of the work site. Remove debris from the site daily, unless otherwise directed. Do not allow accumulations inside or outside the project boundaries. Store materials which cannot be removed daily in areas approved by WETA's Representative.

B. Do not begin demolition and removal work until authorization is received from WETA's Representative. Dispose of demolition materials and debris generated by Design-Builder operations on a daily basis and do not allow accumulation. Remove debris accumulated on temporary scaffolding or on structures as necessary to avoid loss of material during high tide or due to wave or wind action.

C. Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Construct canopy, tent, or other containment system

to prevent contamination of San Francisco Bay when conducting concrete demolition or other similar work. Do not use water if it results in hazardous or objectionable conditions, or which cause pollution to San Francisco Bay. Discharges to Bay waters are not permitted.

D. Provide temporary fixed scaffolding system or float system to catch and contain debris resulting from demolition of elevated platform and other materials. Scaffolding may be supported from existing piles or other suitable means. Provide adequate layers of plastic sheeting or other material for placement over scaffold flooring to collect falling debris. Remove cover sheeting and debris as required by tidal cycles and wave or wind action to prevent loss of material, but not less than once daily on working days.

E. Take all precautions regarding the entry of foreign debris into the Bay water.

F. If used, concrete saw operations shall include a mechanism to collect and containerize dust and cuttings to prevent contamination of San Francisco Bay and the associated shoreline.

G. Remove and dispose of all abandoned items and items serving no useful purpose, such as piping, conduit, wire, and concrete jacket piles and footings below the decking.

H. Identify, cut and cap exposed utilities as required but not limited to those utilities shown on plans.

I. Material generated by the demolition shall be removed daily from the site and shall not be allowed to remain at the site overnight.

J. Provide suitable off-site location for offloading, handling, sorting, and loading of debris generated by the demolition.

1.4 REFERENCES

A. ANSI - American National Standards Institute

1. A10.6 - Demolition Operations - Safety Requirements.

B. California Code of Regulations

1. Title 8 - Industrial Safety Orders, Construction Safety Orders.

1.5 PROTECTION

A. Structures: Protect existing structures that are to remain in place by temporary covers, shoring, bracing, and supports. Perform all operations to avoid breakage, marring, bending or other damage to existing structures or utilities which are to remain. Repair items damaged during performance of the work or replace with new. Do not overload structural elements. Provide new supports or reinforcement for existing structures weakened by demolition or removal work.

B. Personnel and Public: Ensure the safe passage of persons around the area of demolition.

C. Protection of Personnel: During the demolition work, the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of decks, piles, pile caps, walls, or other structural elements will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workers remove debris or perform other work in the immediate area.

D. Utilities: Existing utilities in adjacent locations to remain in service. Contractor shall notify WETA's Representative at least 48 hours in advance of, and obtain written approval for, a temporary utility service interruption. The interruption shall be the minimum duration approved by WETA's Representative to accomplish the required work.

1.6 LOAD LIMITATIONS

A. Design-Builder shall determine vehicle and equipment operating load limits for existing facility structure and submit to WETA's Representative for review and approval.

1.7 HAZARDOUS MATERIALS

A. Design-Builder shall perform his/her own hazardous materials survey for the structures to be removed to identify hazardous materials that will be disturbed by the demolition. Contractor shall remove, handle, store, and dispose of hazardous materials in accordance with all City of Vallejo, Division 1 Specifications, State and Federal regulations and requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

A. Steel Float and Anchor Piles:

Remove existing steel float and anchor piles. All components on the float are to be disposed of with the float. Coordinate with WETA to determine if they would like to keep any additional elements on float.

B. Gangway and Support Structures:

Remove existing gangway and related structures, including but not limited to the temporary gangway support piles and the pile supported concrete dolphin. Piles shall be pulled or broken 2 ft. below the mudline.

C. Entrance Gate:

Remove entrance gate structure and supports. Existing landside handrail shall be removed as required to allow for installation of new gate.

D. Timber Pile Clusters/Dolphins:

Remove existing timber pile cluster/dolphin structures at the northwest and southwest corners of the basin. Piles shall be pulled or broken 2 ft. below the mudline.

E. Temporary Gangway Landing Dolphin:

Remove the existing steel framed and steel pile supported temporary gangway landing dolphin. Piles shall be pulled or broken 2 ft. below the mudline.

F. Utilities: Identify, remove or cut and cap any existing utilities as required.

G. See drawings for additional information. Items not identified in the Contract documents which are encountered during the Design-Builder's work, shall be brought to the attention of the WETA's Representative, who will determine what disposition is to be made of the item(s).

H. The Design-Builder shall not interfere with the use of or access to adjacent facilities.

I. The Design-Builder shall provide and place bracing and shoring to prevent movement or damage to structures and improvements which are to remain. The Design-Builder shall cease operations and notify WETA's Representative immediately if safety or any facility appears to be compromised or endangered. The Design-Builder shall not resume operations until safe conditions have been restored.

3.2 DISPOSITION OF MATERIAL

A. Title to Materials: Title to all materials and equipment to be removed, except as specified otherwise, is vested in the Design-Builder upon receipt of Notice to Proceed. The Owner will not be responsible for the condition or loss of, or damage to, such property after Notice to Proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site but shall first be removed and transported by the Design- Builder to an offsite location.

B. Care in Removal: The Design-Builder shall take care to keep debris, concrete rubble and other materials from falling into the water. No extra compensation shall be made for the retrieval and removal of floating or sunken demolition debris. If in the opinion of WETA's Representative, Design-Builder is not in compliance with the requirements of this Section, containment booms may be required by WETA's Representative at no additional cost to WETA.

3.3 CLEANUP

A. Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage on sidewalks, parking areas or adjacent areas. Clean up spillage from sidewalks, parking areas and adjacent areas.

B. Regulations: Comply with Federal, State, and local hauling and disposal regulations.

END OF SECTION

SECTION 03 23 00

MARINE CONCRETE

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 GENERAL

All cast in place concrete and precast concrete elements shall be designed with the intent of achieving a 50-year minimum design life.

1.2 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.3 DESCRIPTION

A. The work of this section consists of cast-in-place concrete, precast concrete including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following as indicated on the Drawings and specified herein:

1. Pile Supported Concrete Dolphin Caps

1.4 REFERENCES

The latest edition of 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.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M182	Burlap Cloth Made From Jute or Kenaf and Cotton Mats
AASHTO T259	Resistance of Concrete to Chloride Ion Penetration

American Concrete Institute (ACI)

ACI 117	Tolerances for Concrete Construction and Materials
ACI 121R	Quality Assurance Systems for Concrete Construction
ACI 201.2R	Durable Concrete
ACI 211.1	Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214	Evaluation of Strength Test Results of Concrete

ACI 222.3R	Corrosion of Metals
ACI 232R	Use of Fly Ash in Concrete
ACI 233	Ground Granulated Blast-Furnace Slag as a Cementitious Constituent in Concrete
ACI 301	Structural Concrete
ACI 304R	Measuring, Mixing, Transporting, and Placing Concrete
ACI 304.2R	Placing Concrete by Pumping Methods
ACI 305R	Hot Weather Concreting
ACI 306.1	Cold Weather Concreting
ACI 308	Curing Concrete
ACI 309R	Consolidation of Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Structural Concrete
ACI 347R	Formwork for Concrete
ACI SP-2	ACI Manual of Concrete Inspection
ACI SP-4	Formwork for Concrete
ACI SP-15	Structural Concrete for Buildings

American Society for Testing and Materials (ASTM) Publications:

ASTM A 82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A108	Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 416	Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
ASTM A 496	Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 706/A 706M	Low-Alloy Steel Deformed Bars for Concrete Reinforcement
ASTM A 934	Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A 970	Standard Specification for Welded or Forged Headed Bars for Concrete Reinforcement
ASTM C 31	Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Concrete Aggregates
ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 94	Ready-Mixed Concrete
ASTM C 138	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143	Slump of Hydraulic Cement Concrete
ASTM C 150	Portland Cement
ASTM C 171	Sheet Materials for Curing Concrete
ASTM C 172	Sampling Freshly Mixed Concrete
ASTM C 173	Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 227	Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Air-Entraining Admixtures for Concrete
ASTM C 295	Petrographic Examination of Aggregates for Concrete
ASTM C 309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 441	Effectiveness of Mineral Admixtures or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to Alkali-Silica Reaction
ASTM C 469	Static Modulus of Elasticity and Poisson's Ratio of Concrete in

	Compression
ASTM C 494	Chemical Admixtures for Concrete
ASTM C 496	Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 595	Blended Hydraulic Cements
ASTM C 597	Pulse Velocity Through Concrete
ASTM C 618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 642	Density Gravity, Absorption, and Voids in Hardened Concrete
ASTM C 805	Rebound Number of Hardened Concrete
ASTM C 881	Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 920	Elastomeric Joint Sealants
ASTM C 989	Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017	Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1064	Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1157	Blended Hydraulic Cement
ASTM C 1152	Test Method for Acid-Soluble Chloride in Mortar and Concrete
ASTM C 1202	Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
ASTM C 1218	Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
ASTM C 1260	Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM D 512	Chloride Ion in Water
ASTM D 516	Sulfate Ion in Water
ASTM D 1179	Fluoride Ion in Water
ASTM D 1190	Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1339	Sulfite in Water
ASTM D 1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2419	Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 3867	Nitrite-Nitrate in Water
ASTM D 3963	Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel Bars
ASTM D 4397	Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 329	Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

American Welding Society (AWS)

AWS D1.4	Structural Welding Code Reinforcing Steel
AWS C6.1	Friction Welding

U.S. Army Corp of Engineers (USACE)

COE CRD-C-572	Polyvinylchloride Waterstop
PCI-MNL-120	Design Handbook

California Department of Transportation

BMPH (1993) California Stormwater Best Management Practices Handbook - Industrial/Commercial
CA Test 227 (1999) State of California Department of Transportation Test for Evaluating Cleanness of Coarse Aggregate
Caltrans Standard Specifications (2010) State of California Department of Transportation (Caltrans) Standard Specifications

Concrete Reinforcing Steel Institute (CRSI)

Recommended Practice for Placing Reinforcing Bars
Recommended Practice for Placing Bar Supports, Specifications and Nomenclature
Manual of Standard Practice

U.S. General Services Administration (GSA)

FS SS-S-200	Sealants, Joint, Two-Component, Jet-Blast Resistant, Cold-Applied, For Portland Cement Concrete Pavement
FS SS-S-1614	Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Tar Concrete Pavements

California Building Code (CBC), Chapter 17

Special inspection of concrete is required in accordance with Chapter 17 of CBC and shall be paid for by the Design Builder.

1.5 DEFINITIONS

A. "Blending size" is an aggregate that complies with the quality requirements in ASTM C 33 and paragraph entitled "Aggregates" and as modified herein and can be blended with coarse and fine aggregate to produce a well graded combined grading.

B. "Cementitious material" as used herein shall include Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-surface slag, and silica fume; subject to compliance with requirements.

C. "Design strength" (f'c) is the specified compressive strength of concrete to meet structural design criteria.

D. "Marine concrete" is that concrete that will be in contact with or subject to submersion, tidal variations, splash, or spray from water in navigable waterways.

E. "Mixture proportioning" is a description of the proportions of a concrete mixture that were selected to enable it to meet the performance durability requirements, constructability requirements, and the initial and life-cycle cost goals.

F. "Mixture proportions" is the concrete supplier's by-mass proportions to replicate the mixture design.

G. "Pozzolan" is a silicious or silicious and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

H. "Field test strength" (fcr) is the required compressive strength of concrete to meet structural and durability criteria. Determine (fcr) during mixture proportioning process.

1.6 SUBMITTALS

A. Shop Drawings

1. Falsework
   a. Falsework shop drawings and supporting calculations prepared in accordance with established industry standards and signed by a registered Civil Engineer in the State of California. Include proposed schedule and sequence of removing formwork and shoring.
   b. Detail items of form systems affecting appearance of architectural concrete surfaces, such as joints, tie holes, liners, patterns and texture.

2. Reinforcing steel
   a. Submit shop drawings showing fabrication, bending and placing details for complete and accurate location of reinforcement.
   b. Details of reinforcement shall be in accordance with ACI 318 and prepared in accordance with procedures contained in ACI 315.
   c. Reinforcement steel shall not be fabricated or placed before Shop Drawings have been reviewed and returned to Contractor.
   d. ACI 315. Provide bending and cutting diagrams, assembly diagrams, splicing placement and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Only complete drawings will be accepted.

3. Formwork
   a. Prepared in accordance with established standards and in accordance with ACI 347R.
   b. Include design calculations indicating arrangement of forms, sizes and grades of supports (lumber), panels, and related components. Indicate placement schedule, construction, and location and method of forming control joints. Include locations of inserts, pipework, conduit, sleeves, and other embedded items. Furnish drawings and descriptions of shoring and reshoring methods proposed for slabs, beams, and other horizontal concrete members.

4. Construction joints
   a. Show all planned construction and control joint locations.
   b. Reproductions of contract drawings are unacceptable.

5. Crack Repair Work Plan
   a. Submit a crack repair work plan that detailing the materials to be used and procedures to be followed including surface preparation, mixing, application, finishing, curing etc.

B. Product Data

1. Provide product data for all materials incorporated in the structure or used during construction. Data for concrete shall be in accordance with ACI 301.
   a. Materials for curing concrete
   b. Joint sealants
   c. Epoxy bonding compound
   d. Epoxy coatings
   e. Non-shrink grout
   f. Preformed joint filler
   g. Reinforcement supports
   h. Paint for Striping

C. Design Data

1. Concrete Mix Design
   a. At least 30 days prior to concrete placement, submit proportions for a concrete mixture for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, aggregate, fly ash, or pozzolans, corrosion inhibitors; and applicable reference specifications. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submittal shall clearly indicate where each mixture will be used when more than one mix design is submitted. The approval of aggregate, fly ash, and pozzolan tests results shall have been within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement. The mixture shall be prepared by an accredited laboratory experienced in this field and under the direction of a licensed/registered civil engineer, who shall sign all reports and designs.
   b. Mix designs shall be subject to review by WETA's Representative and by the Testing Agency.

2. Source Limitations
   a. All cementitious material shall be from the same plant, aggregates from a single source and admixtures from a single manufacturer.
   b. Material shall remain unchanged throughout the project

D. Test Reports

1. Cement
   a. Submit test results in accordance with ASTM C 150 Portland cement. Submit current mill data.

2. Water
   a. Submit test results in accordance with ASTM D 512 and ASTM D 516.

3. Concrete Mix Design
   a. Submit copies of test reports in accordance with ACI 301 and ASTM C 1077 showing that the mix has been successfully tested to produce concrete with the properties specified and that mix shall be suitable for the job conditions. Obtain approval before concrete placement. ACI 211.1 and ACI 301 except as otherwise specified. The trial batch procedure shall be used exclusively when a shrinkage limit is specified.
   b. Ingredients. Provide certified test reports which clearly show the specified requirements together with the applicable test results for all ingredients contained in the concrete comply with standards established in accordance with the mix design.

4. Concrete Mixture Proportions
   a. Fully describe the processes and methodology whereby mixture proportions were developed and tested and how proportions will be adjusted during progress of the work to achieve, as closely as possible, the designated levels of relevant properties.

5. Fly Ash and Natural Pozzolan
   a. Submit test results in accordance with ASTM C 618. Submit test results performed within 6 months of submittal date.

6. Aggregates
   a. Submit test results for aggregate quality in accordance with ASTM C 33, and the combined graduation curve for grading proposed for use in the work and used in the mixture qualification, and ASTM C 295 for results of petrographic examination. Where there is potential for alkali-silica reaction, provide results of tests conducted in accordance with ASTM C 227 or ASTM C 1260. Submit results of all tests during progress of the work in tabular and graphical form as noted above, describing the cumulative combined aggregate grading and the percent of the combined aggregate retained on each sieve.

7. Admixtures
   a. Submit test results in accordance with ASTM C 494 and ASTM C 1017 for concrete admixtures, ASTM C 260 for air-entraining agent, and manufacturer's literature and test reports for corrosion inhibitor. Submitted data shall be based upon tests performed within 6 months of submittal. Use a commercially formulated corrosion inhibitor, which is non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor, capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete. Grace Construction Products, W.R. Grace & Co.; DCI-S or approved equal.

8. Special Inspection
   a. Perform special inspection of all reinforcing steel placement, embedded items placement, concrete placement and all concrete curing. Employ approved special inspectors, as required Division 1 Section "Quality Assurance", from an approved independent commercial testing laboratory to perform such inspection.
   b. Reports to be submitted to include results from concrete compression, yields, air content and slump test.

E. Admixtures

For all the admixtures used in each concrete mix, at a minimum, submit for approval data sheets, certificates and test reports.

F. Quality Control

1. Develop and submit for approval a quality control plan in accordance with the guidelines of ACI 121R and as specified herein. The plan shall include plans for the concrete supplier, the reinforcing steel supplier, and installer. Maintain a copy of ACI SP-15 and CRSI Manual of Practice at the project site.

2. Curing compounds / curing concrete elements
   a. Submit proposed materials and methods for curing concrete elements.

3. Form removal schedule
   a. Submit schedule for form removal indicating element and minimum length of time for form removal. Submit technical literature of forming material or liner, form release agent, form ties, and gasketing to prevent leakage at form and construction joints. Provide a full description of materials and methods to be used to patch form-tie holes.

4. Concrete placement and compaction
   a. Submit technical literature for equipment and methods proposed for use in placing concrete. Include pumping or conveying equipment including type, size and material for pipe, valve characteristics, and the maximum length and height concrete will be pumped. No adjustments shall be made to the mixture design to facilitate pumping.
   b. Submit technical literature for equipment and methods proposed for vibrating and compacting concrete. Submittal shall include technical literature describing the equipment including vibrator diameter, length, frequency, amplitude, centrifugal force, and manufacturer's description of the radius of influence under load. Where flat work is to be cast, provide similar information relative to the proposed compacting screed or other method to ensure dense placement.
   c. Provide Cold and Hot placement of concrete mixture plan.

5. Field testing technician and testing agency
   a. Submit data on qualifications of proposed testing agency and technicians for approval by WETA's Representative prior to performing any work.
   b. Work on concrete under this contract shall be performed by an ACI Concrete Field- Testing Technician Grade 1 or Grade 2 qualified in accordance with ACI SP-2 or equivalent. Equivalent certification programs shall include requirements for written and performance examinations as stipulated in ACI SP-2.
   c. Testing agencies that perform testing services on reinforcing steel shall meet the requirements of ASTM E 329.
   d. Testing agencies that perform testing services on concrete materials shall meet the requirements of ASTM C 1077.
   e. Testing Agency shall not be affiliated with the concrete supplier.

6. Mixture designs

   a. Provide a detailed report of materials and methods used, test results, and the field test strength (fcr) for marine concrete required to meet durability requirements.

7. Corrosion Inhibiting Additive Certification from manufacturer attesting that the proposed product has been in use for five years in waterfront concrete construction without harmful reactivity with cement, aggregate or reinforcing.

8. Mill Test Reports. Submit certified mill test reports and manufacturer's certification for each heat of steel used for reinforcing bars and mechanical splice device.

9. Welding certificates

G. Manufacturer's Field Reports

1. Concrete batch tickets

1.7 MODIFICATION OF REFERENCES

A. Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean WETA's Representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver concrete until: forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. ACI 301 for job site storage of materials. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground. Protect materials from contaminants such as grease, oil, and dirt.

B. Storage facilities shall be weather tight and dry.

C. Deliver and store packaged materials in original containers with seal unbroken and labels intact until time of use.

D. Ensure materials can be accurately identified after bundles are broken and tags removed.

E. Store coarse and fine aggregates in separate, covered bins to prevent mixing and to preserve moisture content of aggregate at batching plant.

F. Store bulk cement in covered bins.

PART 2 - PRODUCTS

2.1 CONCRETE

A. General Requirements

1. Concrete shall be a high quality mix in accordance with the requirements of this specification, ACI 211.1 and ACI 301 capable of providing strength, durability, density and minimum chloride ion concentration. Concrete cracking shall be minimized.
2. The Contractor shall use the proper combination of low shrink materials, low temperature concrete, low penetration concrete, re-vibration or re-floating finishing techniques, fog sprays during finishing, or other procedures as necessary to minimize the development of shrinkage cracks.

B. Durability and Strength

1. ACI 201.2R and ACI 211.1.

C. Contractor-Furnished Mixture Proportions

1. Strength and Water-Cementitious Materials Ratio. Strength requirements shall be based on 28-day compressive strength determined on 6 by 12 inch cylindrical specimens in accordance with ASTM C 39. The specified compressive strength of the concrete (f'_c) for each portion of the structure shall meet the requirements listed below.
2. Design of all concrete mixes shall be provided by a qualified concrete technologist hired and paid for by the Contractor. The mixture proportions for marine concrete shall be proportioned on the basis of trial batch data or field test reports in accordance with ACI 301. Design mixture shall produce the design strength (f'c) and provide durability, workability, and mixture consistency to facilitate placement, compaction into the forms and around reinforcement without segregation or bleeding.
3. Class "F" fly ash may be used to replace 25 percent of the total cement that would otherwise be used.
4. Cementitious materials are to be batched separately.
5. Slump. The concrete mixture shall be proportioned to have, at the point of deposit, a maximum slump of 4 inches as determined by ASTM C 143. Where an ASTM C 494, Type F or G admixture is used, the slump after the addition of the admixture shall be no less than 6 inch nor greater than 8 inch. Slump tolerances shall comply with the requirements of ACI 117.
6. Chloride Ion Penetration. To ensure the durability of concrete in marine environment, concrete shall be proportioned to have the chloride ion penetration test in accordance with ASTM C 1202 and be below 750 coulombs for concrete specimens tested at 28 days. Alternatively, a ponding test in accordance with AASHTO T259 may be performed to validate chloride ion penetration in accordance with ASTM C 1202.

D. Required Average Strength of Concrete

1. The minimum compressive strength (f_{cr}) of the selected mixture shall equal or exceed the strength required under ACI 301 for laboratory mixture designs and which passes the test indicated in the subparagraph entitled "Chloride Ion

Penetration." The average compressive strength produced under field tests shall be the minimum compressive strength (f_{cr}) required during construction.

E. Shrinkage Limits of Mix Designs

1. Mix designs for concrete specified to include a shrinkage limit shall meet these additional requirements to limit shrinkage. The selected mixture shall produce limits on shrinkage. Drying shrinkage of concrete for mix design trial batches after 21 days of drying shall not exceed 0.040 percent based on the averaged results from three or more specimens constituting a test set; however, the results from any individual specimen from the trial batches which are less than the shrinkage value obtained by subtracting 0.009 percent shrinkage from the average shall be discarded and a new average established. Test procedures and test specimens shall conform to the following:

   The "Drying Shrinkage" specimens shall be 3 inch x 3 inch by 11 inch prisms with an effective gage length of 10 inch and be fabricated, cured, dried and measured in the manner outlined in ASTM C 157 and modified as follows: Specimens shall be removed from molds at an age of 24 hours plus or minus one hour after trial batching, shall be placed immediately in lime saturated water between 70 and 77 degrees Fahrenheit for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water between 70 and 77 degrees Fahrenheit. Measurement to determine expansion expressed as a percentage of original length shall be made at age seven days. This length at age seven days shall be the base length for drying shrinkage calculations. Specimens then shall be stored immediately in a humidity control room maintained at between 70 and 77 degrees Fahrenheit and 50 percent plus or minus 4 percent relative humidity for the remainder of the test. Measurement to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, and 21 days of drying after 7 days of moist curing.

2. Cast-in-Place, Precast Concrete and all other Concrete not otherwise indicated

a.	Minimum 28-day compressive strength, f'c	5,000 psi
b.	Maximum water-cementitious material ratio, w/cm (by weight of cementitious ingredients)	0.40
c.	Cementitious Materials Composition	
	Cement / cubic yard:	75%
	SCM(i) / cubic yard:	25%
d.	Maximum aggregate size, ASTM C 33	1.0 inch
e.	Shrinkage limit requirement	YES
f.	Range of air entrainment	1-4%
g.	Maximum acid-soluble chloride ion content (percent by weight of cementitious ingredients)	0.10

   (i) SCM: Supplementary Cementitious Material – Fly Ash, Ground Granulated Blast Furnace Slag or a combination of both with fly ash not to exceed 25%.

2.2 MATERIALS

A. Cement

ASTM C 150, Type II low alkali. The tricalcium aluminate (C_3A) content shall not be less than 3 percent to provide protection for the reinforcement and shall not be more than 8 percent to obtain concrete that is resistant to sulfate attack. Use one manufacturer for each type of cement, fly ash, and pozzolan.

B. Fly Ash

1. ASTM C 618, Type F. Fly ash shall have a maximum allowable loss on ignition no greater than 6 percent, a maximum SO_3 content of 3 percent by weight and a maximum water content of 3 percent and a maximum water requirement of 100 percent. Add with cement.

C. Water

1. Water shall be potable, comply with the requirements of ASTM C 94 and the chloride and sulfate limits in accordance with ASTM D 512 and ASTM D 516. Mixing water shall not contain more than 500 parts per million of chlorides as Cl and not more than 100 parts per million of sulfates as SO_4. Water shall be free from injurious amounts of oils, acids, alkalis, salts, and organic materials. Where water from reprocessed concrete is proposed for use in the work, submit results of tests to verify that the treatment has negated adverse effects of deleterious materials.

D. Aggregates

1. ASTM C 33, except as modified herein. Aggregates shall be crushed stone and shall not contain any substance which may be deleteriously reactive with the alkalies in the cement. Aggregates shall show expansions less than 0.10 percent at 6 months when tested in accordance with ASTM C 227 using a cement with an alkali content above 0.8 percent (expressed as sodium oxide) and shall not possess properties or constituents that are known to have specific unfavorable effects in concrete when tested in accordance with ASTM C 295. For fine aggregate, the amount passing a No. 200 sieve shall not exceed 3 percent and the amount of coal and lignite shall not exceed 0.5 percent and the sand equivalent value shall be no less than 75 in accordance with ASTM D 2419. For coarse aggregate, the deleterious substances shall not exceed those permitted for Class 4M and the cleanness value shall be no less than 75 in accordance with CA Test 227.
2. Provide aggregates for exposed concrete from one source in accordance with ASTM C 227.
3. Where a size designation is indicated, that designation indicates the nominal maximum size of the coarse aggregate.
4. Where historical data is used, provide aggregates from the same sources having the same size ranges as those used in the concrete represented by historical data.
5. No frozen aggregates will be permitted.

E. Non-shrink Grout

1. ASTM C 1107. The grout shall be free of chlorides and nonmetallic. Minimum compressive strength shall be no less than 4,500 psi at 7 days and 7,000 psi at 28 days.

F. Admixtures

1. Do not use calcium chloride admixtures. Concrete shrinkage limits specified herein are for concrete containing admixtures. Mix designs and trial batches of structural concrete shall be reflective of the types, brands, and amounts of admixture to be used in the production concrete; changes require the preparation of new mix designs. Use chemical admixtures that comply with manufacturer's recommendations, and appropriate for the climatic conditions and the construction needs.
2. The total alkali content shall not increase the total sodium-oxide equivalent alkali content of the concrete by more than 0.5 lb/yd^3.
3. Use water-reducing admixture in concrete as required for placement and workability. Unspecified admixtures will not be permitted unless specifically approved by WETA's Representative and by the Testing Agency.
4. Air Entraining Admixture - Provide air entraining admixtures conforming to ASTM C 260. Provide the admixture of such a type and dosage that the total air content in the hardened concrete can be readily maintained within the limits specified elsewhere in this section.
5. Accelerating - ASTM C 494, Type C.
6. Retarding - ASTM C 494, Type B, D, or G.
7. Water Reducing - ASTM C 494, Type A, E, or F.
8. High Range Water Reducer (HRWR) - ASTM C 494, Type F and ASTM C 1017.
9. All concrete shall contain a calcium nitrite corrosion inhibiting solution that conforms to the requirements in ASTM C 494, Type C, as follows:
    a. The calcium nitrite admixture shall be as manufactured by W.R. Grace, "DCI-S", or approved equal.
    b. The calcium nitrite admixture shall be added to the concrete at the rate of 2.5 gallons per cubic yard for the fixed pier deck slab and other miscellaneous concrete and 4.0 gallons per cubic yard for prestressed concrete piles.
    c. The water in the corrosion inhibiting solution shall be considered as part of the mixing water.

G. Materials for Forms

1. Provide wood, plywood, or steel. Forms for exposed concrete shall be of steel or plywood APA grade-stamped “B-B Plyform Class 1 Exterior”. Use plywood or steel forms where a smooth form finish is required. Lumber shall be square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Plywood: PS-1, B-B concrete form panels or better. Steel form surfaces shall not contain irregularities, dents, or sags.
2. Form accessories shall be "Superior", "Burke," or approved equal, plastic-coated or plastic. Wire is not acceptable, nor is ties which remain exposed, or could cause rusting or spalling of concrete.
3. Chamfer Strips. Wood, metal rubber or PVC strips, ¾” x ¾” minimum, or as noted on the Drawings.

H. Form Ties and Form-Facing Material

1. Provide a form tie system that does not leave mild steel after break-off or removal any closer than 2 inches from the exposed surface. Do not use wire alone. Form ties and accessories shall not reduce the effective cover of the reinforcement.
2. Form-facing material shall be structural plywood or other material that can absorb air trapped in pockets between the form and the concrete and some of the high water-cementitious materials ratio surface paste. Maximum use is three times. Provide forms with a form treatment to prevent bond of the concrete to the form.
3. As an alternate to using an absorptive wood form contact face as a form liner, use "DuPont Zemdrain" or an approved equal in strict accordance with the manufacturer's recommendations.

I. Reinforcement

1. Reinforcing Bars
   a. Reinforcing bars. ASTM A 615 (mild steel) Grade 60, deformed.
   b. Low Alloy Steel Reinforcing bars: ASTM A 706 Grade 60, deformed.
   c. Reinforcing steel shall be fusion bond epoxy coated per ASTM A775 or hot dip galvanized per ASTM A767.
2. Headed Bar Reinforcement
   a. The fabrication, material, testing, physical characteristics, inspection and marking of Headed Bar Reinforcement shall conform to ASTM A 970 except as modified in this section.
   b. All bar reinforcement material used in the fabrication of headed bar reinforcement shall conform to ASTM A 706.
   c. The manufacturer of welded headed bar reinforcement shall keep a daily production log for each day of production.
      1) The log shall clearly indicate the production lot numbers, the heats of bar material and head material used in the manufacture of each production lot, the number of bars in each production lot, welding records, including tracking and production parameters for all welds, and results of all tests performed.
      2) A test report shall be furnished by the manufacturer containing, on a per heat basis, the chemical analysis of the bar and of the head material, including all elements represented in the carbon equivalent formula in ASTM A706, in addition to phosphorus and sulfur.
      3) A production lot of welded headed bar reinforcement is defined as 150 reinforcing bars, or fraction thereof, of the same bar size, with welded heads of the same size and type, produced from bar material of a single heat number and head material of a single heat number. A new production lot shall be started if the heat number of either the bar material or the head material changes before the maximum production lot size of 150 is reached.
      4) The daily production log shall be submitted in writing to WETA's Representative within 7 calendar days following the manufacture of any welded headed bar reinforcement.
   d. Welding, welder qualifications, and inspection of welding shall conform to the requirements for welding in ANSI/AWS D1.4, and, for friction welding, in ANSI/AWS C6.1.

e. All welding shall be performed at an established and permanent fabrication facility.
f. All headed bar reinforcement shall be tagged in such a manner that the production lot can be accurately identified at the job site. In addition each bar shall be marked as follows:
1) Marking shall be legibly stamped onto the flat outer side of the head, away from the bar, to denote the following:
- Point of origin - Letter or symbol defining the manufacturer and location.
- Type of Welded Headed Reinforcing Bar -"A 970" indicating that the welded headed bar reinforcement was produced to this specification.

3. Mechanical Reinforcing Bar Connectors
a. ACI 301. Provide 125 percent minimum yield strength of the reinforcement bar.
4. Stud Shear Connectors
a. Shear connector studs shall be made from cold-drawn bars, Grades 1015, 1018 or 1020, either semi-or fully-killed, conforming to ASTM A108, and shall have a minimum yield and tensile strength of 50 ksi and 60 ksi, respectively.
5. Wire for Pile Build-Ups
a. ASTM A 82.

J. Reinforcing Bar Supports and Accessories

1. Provide bar ties and supports of coated or non-corrodible material conforming with ASTM D 3963.
2. All spacers, chairs, bolsters, and other devices necessary for proper reinforcing steel placement shall be epoxy coated with nylon tipped legs. All reinforcing steel shall be adequately tied with nylon, epoxy, or plastic-coated tie wire and supported with epoxy-coated chairs that hold the bars to the specified clearance. One chair sample shall be submitted to the Engineer for review. No clay or concrete bricks or any other material other than reviewed chairs shall be permitted to support reinforcing steel.
3. Bonding Agent and Fusion Bonded Epoxy Coating Touch-Up:

K. Polyvinylchloride Water Stops

1. COE CRD-C-572. Submit manufacturer's data sheets and recommended installation procedures including details for splicing.

L. Materials for Curing Concrete

1. Vapor Barrier
a. ASTM D 4397 polyethylene sheeting, minimum 0.01 inch (0.25 mm) thickness.
2. Pervious Sheeting
a. AASHTO M182.
3. Liquid Membrane-Forming Compound
a. ASTM C 309, white-pigmented, Type 2, Class B.

M. Expansion/Contraction Joint Filler

1. ASTM D 1751 or ASTM D 1752, 0.5 inch thick, unless otherwise indicated.

N. Joint Sealants

1. Horizontal Surfaces, 3 Percent Slope, Maximum
   a. ASTM C 920, Type M, Class 25, Use T.
2. Vertical Surfaces Greater Than 3 Percent Slope
   a. ASTM C 920, Type M, Grade NS, Class 25, Use T. FS SS-S-1614 FS SS-S-200, no sag.

O. Epoxy Bonding Compound

1. ASTM C 881. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 4 degrees C; Class B if placement temperature is between 39 and 61 degrees F; or Class C if placement temperature is above 61 degrees F.
2. Provide for setting of anchors and dowels into existing concrete in areas indicated on the drawings.

PART 3 - EXECUTION

3.1 FORMS

A. The Contractor shall be responsible for the design, construction, installation, and removal of formwork. Formwork shall meet the applicable requirements of ACI 347, including those for loads, stresses and deflection limits and the following:

1. It will be necessary to support the onshore cap beam and monopile cap formwork system from the piling.
2. No drilling of holes in the piles will be permitted, except that WETA's Representative may allow the drilling of vertical holes in the tops of piles to accommodate formwork anchors. The locations, diameter and depths of such holes shall have WETA's Representative's prior approval. WETA's Representative may allow holes perpendicular to the pile length to be performed during pile casting, subject to the following limitations:
   a. Holes shall be at least 3 feet from the pile head.
   b. Holes shall have a maximum diameter of 1-1/2 inches.
   c. Holes shall be located midway between pile tensioning strands.
   d. Holes shall be filled with an approved epoxy grout immediately after use.
3. Alternatively WETA's Representative will consider the use of pile attachments which rely upon friction. Before using any such attachments, the Contractor shall demonstrate physically, to WETA's Representative's satisfaction, that they will not move under construction loads and that the piles will be undamaged.
4. Steel beams or other shapes which are to remain embedded in the onshore cap concrete shall have at least the cover required for concrete reinforcement. Their size and location shall be such that no vertical displacement of top or bottom horizontal reinforcement is necessary, nor any change in the elevation of the deck slab or top or soffit.

5. Hanger rods projecting into or through the concrete shall be screw-anchored to support member embedded in the concrete, so that the rods may be removed after use. After their removal, no metal part shall remain within 3 inches of the face of the concrete. The holes left by their removal shall be filled as for form-tie cavities.
6. Whatever the formwork support system adopted, the Contractor shall be responsible for the integrity of the piles and for any damage caused to them.
7. Provision shall be made for securing expansion joint material firmly and without damage during concrete placement.
8. Exposed concrete corners shall have a ¾-inch chamfer unless otherwise specifically shown on the Plans.

B. Surface Tolerances

1. Formwork will be so designed that the concrete surfaces will conform to the tolerances of ACI 347R, unless indicated otherwise. In particular, the following tolerances shall apply:
   a. Soffit of deck: +0", -3/4" (in elevation)
   b. Surface of deck (top): -0", + 1/2" (in elevation) and not more than + 1/4" in 10 feet.

C. Construction of Formwork

1. Construction of formwork shall be in accordance with the following:
2. ACI 347R and Section 6.1 of ACI 318.

Form surfaces and edges shall produce concrete conforming to the detailed shapes, lines and dimensions, and free from cavities and honeycombing. Exposed concrete surfaces shall be free from protrusions, fins, roughness and other imperfections. Forms shall be strong, flat and rigid and be set true to line and level. They shall be fixed firmly in place and shall resist, without movement, the weight and pressures of wet concrete, and all loads incidental to its placement.

1. Form accessories to be partially or wholly embedded in the concrete, such as ties and anchors. The anchors shall not be left in place but shall be carefully removed and the holes neatly filled with the specified dry-pack mortar.
2. All concrete embedments and penetrating items requiring attachment to forms shall be accurately located and rigidly secured so that they will not become displaced during concrete placement.
3. Form joints shall be sufficiently tight to prevent leakage of grout or cement paste.
4. Plywood and other wood surfaces subject to shrinkage shall be sealed against absorption of moisture from the concrete by either (1) a form oil such as "Formfilm," manufactured by A. C. Horn or approved equal; or (2) a factory applied non-absorbent liner.
5. When forms are coated to prevent bond with concrete, coating shall be applied prior to placing of the reinforcing steel. Coating material shall not be allowed on concrete against which fresh concrete will be placed.
6. Before placing concrete, the forms shall be thoroughly cleaned of all foreign material. Before placing concrete, all reinforcement shall be checked by the Contractor to ensure that each bar is accurately set and anchored against movement such that specified clearances will exist in the finished concrete.
7. The Contractor shall notify WETA's Representative in writing at least 24 hours in advance for each successive placement of concrete that the forms are

ready to be inspected by WETA's Representative. No concrete shall be placed until WETA's Representative has given written approval to begin placing.

8. ACI 301. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 3/4 inch unless otherwise indicated. Forms submerged in water shall be watertight.
9. Provide formwork with clean-out openings to permit inspection and removal of debris. Formwork shall be gasketed or otherwise rendered sufficiently tight to prevent leakage of paste or grout under heavy, high-frequency vibration. Use a release agent that does not cause surface dusting. Limit reuse of plywood to no more than three times. Reuse may be further limited by WETA's Representative if it is found that the pores of the plywood are clogged with paste to the degree that the wood does not absorb the air or the high water-cementitious materials ratio concrete surface.
10. Patch form tie holes with a non-shrink patching material in accordance with the manufacturer's recommendations and subject to approval.

D. Coating

1. Before concrete placement, coat the contact surfaces of forms with a nonstaining mineral oil, nonstaining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

E. Construction

1. Formwork shall be observed continuously while concrete is being placed to ensure that there are no changes of elevation, plumbness or camber. If, during construction, any weakness develops and the falsework shows settlement or distortion, the work shall be stopped, the affected construction removed if permanently damaged, and the falsework strengthened as necessary to eliminate further settlement or distortion.

F. Removal of Forms and Supports

1. After placing concrete, forms shall remain in place for the time periods specified in ACI 347R, except for concrete placed underwater, forms shall remain in place 48 hours to prevent concrete damage during form removal.

G. Special Requirements for Reduced Time Period

1. Forms may be removed earlier than specified if ASTM C 39 test results of field-cured samples from a representative portion of the structure or other approved and calibrated non- destructive testing techniques show that the concrete has reached a minimum of 85 percent of the design strength.

H. Reshoring

1. Do not allow construction loads to exceed the superimposed load which the structural member, with necessary supplemental support, is capable of carrying safely and without damage. Reshore concrete elements where forms are removed prior to the specified time period. Do not permit elements to deflect or accept loads during form stripping or reshoring. Forms on columns, walls, or other load-bearing members may be stripped after 2 days if loads are not applied to the members. After forms are removed, slabs and beams over

10 ft in span and cantilevers over 4 feet shall be reshored as required. Perform reshoring operations to prevent subjecting concrete members to overloads, eccentric loading, or reverse bending. Reshoring elements shall have the same load-carry capabilities as original shoring and shall be spaced similar to original shoring. Firmly secure and brace reshoring elements to provide solid bearing and support.

3.2 FABRICATION: REINFORCING STEEL

A. Comply with details on Drawings and fabricate reinforcing in accordance with CRSI Manual of Standard Practice.

B. Reinforcing steel shall be cut and bent cold to exact lengths and shapes required.

C. Contractor is responsible for providing reinforcement that will comply with Contract Documents within tolerances specified.

3.3 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

A. Installation

1. Comply with CRSI Manual of Standard Practice and ACI 301.
2. Remove rust, scale, oil, grease, clay, or foreign substances from reinforcing that would reduce the bond with concrete.
3. Tack welding of reinforcement bars is prohibited.
4. Reinforcement Supports
   a. Place reinforcement and secure with non-corrodible chairs, spacers, or metal hangers. Support reinforcement on the ground with concrete or other non-corrodible material, having a compressive strength equal to or greater than the concrete being placed.
5. Splicing
   a. As indicated on contract drawings. For splices not indicated, see ACI 315.
6. Cover
   a. Minimum concrete cover for reinforcement is 3 inches unless noted otherwise. Placement tolerance is 1/4 inch.
7. Securely tie rebar and support reinforcement to prevent displacement by construction traffic and during casting of concrete and to maintain minimum concrete cover. Displacement of reinforcement shall be immediately corrected.
8. Tie wires shall be bent away from form.
9. Reinforcement shall not be bent after being embedded in hardened concrete.
10. Prior to placing concrete, reinforcement shall be inspected and, if necessary, cleaned, relocated, and tied at no additional cost to WETA.

B. Setting Miscellaneous Material

1. Place and secure bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Take particular care to firmly secure items such as conduits, and the like, that need to be held in position against hydraulic pressure from flowable concrete. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete. Electrically isolate exposed steel

work and its anchor systems from the primary steel reinforcement with at least 2 inches of concrete.

C. Setting Anchors and Dowels into Existing Concrete

1. Holes in existing concrete shall be drilled to the size indicated on the drawings and appropriate for the type of grout to be used. Holes shall be thoroughly cleaned and inspected prior to grouting.
2. Grout shall be cement or epoxy resin as indicated on the drawings. Submit manufacturer's data sheets and installation procedures for approval prior to grouting.

3.4 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

A. General Information

1. Batching Plant Conditions. Ensure equipment and plant will provide accurate weighing, minimize segregation and will efficiently handle materials to the satisfaction of WETA's Representative and the Testing Agency.
2. Equipment. Thoroughly clean concrete equipment before use to avoid contamination.

B. Batching

1. ASTM C 94, ACI 301, and ACI 304R, except as modified herein. Batching equipment shall be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch tickets imprinted with mix identification, batch size, batch design and measured weights, moisture in the aggregates, and time batched for each load of ready-mix concrete. When a pozzolan is batched cumulatively with the cement, it shall be batched after the cement has entered the weight hopper.

C. Measuring

1. Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing."
2. Adjust batch proportions to replicate the mixture design using methods provided in the approved quality assurance plan. Base the adjustments on results of tests of materials at the batch plant for use in the work. Maintain a full record of adjustments and the basis for each.

D. Mixing

1. ASTM C 94 and ACI 301. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, if both the specified maximum slump and water-cementitious material ratio are not exceeded. When water is added, an additional 30 revolutions of the mixer at

mixing speed is required. If time of discharge exceeds time required by ASTM C 94, submit a request along with description of precautions to be taken. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

E. Transporting

1. Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.5 PLACING CONCRETE

1. Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Notify WETA's Representative and Testing Agency at least 48 hours before placing concrete.

2. Place concrete within 1 hour of adding water, unless otherwise specified. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent separation from rehandling and flowing.

3. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water.

4. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms.

5. Take precautions to avoid displacement of reinforcement and formwork.

6. Do not add water to concrete during delivery, at the site, or during placement unless specifically approved by the WETA's Representative and the Testing Agency.

7. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of three feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other or lifts for vertical construction. Position grade stakes on 10 ft centers maximum in each direction when pouring interior slabs and on 20 ft centers maximum for exterior slabs.

8. Place concrete as continuous operation to permit proper and thorough integration and to complete scheduled placement.

9. Consolidate concrete in accordance with ACI 301 to ensure proper encasement of reinforcement, around embedded items and into corners.

10. Retempering of concrete which is partially set will not be permitted.

A. Vibration

1. Comply with the requirements of ACI 309R and ASTM A 934/A 934M using vibrators with a minimum frequency of 9000 vibrations per minute (VPM). Use only high cycle or high frequency vibrators. Motor-in-head 60 cycle vibrators may not be used. For walls and deep beams, use a minimum of two vibrators with the first to melt down the mixture and the second to thoroughly consolidate the mass. Provide vibrator at each point of deposit during simultaneous placing to ensure timely consolidation. Ensure that a spare vibrator is at the casting site whenever concrete is placed. Place concrete in 22 inch maximum vertical lifts. Insert and withdraw vibrators approximately 20 inch apart. Penetrate at least 8 inches into the previously placed lift with the vibrator when more than one lift is required. Extract the vibrator using a series of up and down motions to drive the trapped air out of the concrete and from between the concrete and the forms.
2. For slab construction use vibrating screeds designed to consolidate the full depth of the concrete. Where beams and slabs intersect, use an internal vibrator to consolidate the beam. Do not vibrate concrete placed with anti-washout admixtures. Vibrators shall be equipped with rubber vibrator heads.
3. Do not place vibrators against reinforcement, attach to forms, or use to spread concrete.

B. Pumping

1. ACI 304R and ACI 304.2R. Pumping shall not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment shall not exceed 2 inches. Do not use pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of coarse aggregate to 33 percent of the diameter of the pipe. Maximum size of well-rounded aggregate shall be limited to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

2. Space points of deposit to eliminate need for lateral flow. Take special care to fill each part of forms by depositing concrete directly as near the final position as possible.

C. Interruptions

1. Interruptions in placement lasting longer than 45 minutes shall be cause for discontinuing placement for the remainder of the day.
2. In this event, cut concrete back and provide construction joint as directed.
3. Clean forms and reinforcement as necessary to receive concrete at a later time.

D. Cold Weather

1. Mean daily temperature falls below 40 degrees F.

2. ACI 306.1. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when ambient temperature is below 39 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the

structure while curing. Limit the rate of cooling to 5 degrees F in any one hour and 18 degrees F per 24 hours after heat application.

E. Hot Weather

1. Mean daily temperature rises above 90 degrees F.

2. ACI 305R. Maintain required concrete temperature using Figure 2.1.5, "Effect of Concrete Temperatures, Relative Humidity, and Wind Velocity on the Rate of Evaporation of Surface Moisture From Concrete" in ACI 305R to prevent the evaporation rate from exceeding 0.2 pounds per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.6 FINISHES FOR HORIZONTAL CONCRETE SURFACES

A. Formed Surfaces: Remove fins and projections, patch, and leave "as formed". Air bubbles or "bug-holes" not exceeding 3/16" diameter need not be repaired.

B. Flatwork: Unless otherwise noted or specified, slabs shall be finished monolithically.

C. Broom Finish: After the concrete has received a float finish, the surface shall be given a non-slip medium broom finish.

D. Trowel Finish (Typical for interior exposed areas): After the concrete slab has been float finished, the surface shall be troweled at least twice to a smooth, dense, uniform finish free of defects and blemishes. Jitterbugs shall not be used. No dry cement or mixture of dry cement and sand shall be sprinkled on the surface

3.7 TREATMENT OF CRACKS IN CONCRETE

1. The surface crack intensity of the pier structure is indicated by the number and size of shrinkage cracks in the horizontal and vertical surfaces of the visible concrete. Inspection and repairs shall be provided by the Contractor at no cost to WETA.
2. The Contractor shall be required to remove all equipment and materials from the pier and clean the surface as necessary to permit the inspection and measurement of the crack intensity. This will occur after completion of concrete cure and prior to release of falsework for the top surfaces. Invert surfaces shall be inspected and measured after the removal of the falsework and forms.
3. Crack width shall be measured with an approved hand held microscope type crack comparator and determined at the concrete surface.
4. Cracks that shall be repaired:

a. Cracks or portions of cracks that are more than 0.02 inches wide for a length of 2 feet;
b. Cracks or portions of cracks exceeding a length of 3 feet where one third or more of that crack, or portion of a crack for each 3 feet of length, exceeds a width of 0.02 inches.

5. Repair method for horizontal slab surfaces: clean cracks of dust, oil, disintegrated material, or any debris that could block the free flow of the resin. Chip, saw or rout surface edges of crack to form a trough. Fill top surfaces of crack by gravity feed with a suitable type, grade and class of epoxy bonding compound. Seal exposed bottom surfaces of crack as specified below for vertical surfaces.
6. Repair method for vertical surfaces: Prepare cracks as specified above and seal crack at surface by trowel application with a suitable type, grade and class of epoxy bonding compound.
7. Repair method for piles:

a. Cracks over 0.02 to 0.04 inches wide shall be repaired as required above for horizontal surfaces and vertical surfaces.
b. Cracks over 0.04 inches shall be repaired by epoxy injection as directed by WETA's Representative.

3.8 CURING AND PROTECTION

1. ACI 301 and ACI 308 unless otherwise specified. Prevent concrete from drying by misting surface of concrete. Begin curing immediately following final set.
2. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, by rain or running water, adverse weather conditions, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains.
3. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded.
4. Cure all formed surfaces including undersides of beams, supported slabs and similar surfaces by moist curing with forms in place. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period.
5. Provide moist curing for those areas receiving liquid chemical sealer-hardener or epoxy coating.

A. Spray on Curing Compound

1. Surfaces of concrete which are exposed to the air shall be cured with a spray on curing compound as per the procedures specified in Curing Compound Method section 90-1.03B(3) of Caltrans Standard Specifications.

B. Forms in Place Method

1. Formed surfaces of concrete may be cured by retaining the forms in place and following the curing procedures specified in section 90-7.01D of Caltrans Standard Specifications.

C. Pervious Sheeting

1. Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6 inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.

D. Impervious Sheeting

1. Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 1 foot minimum. Provide sheeting not less than 1.5 feet wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls, and other vertical structural elements from the top down with impervious sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.

E. Temperature of Concrete during Curing

1. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceed 5 degrees F in one hour, and 50 degrees F in a 24-hour period.

3.9 FIELD QUALITY CONTROL

F. Inspections

1. Construction of formwork is complete.
2. Placement of required reinforcement, inserts and embedded items is complete.
3. Form ties at construction joints are tight.
4. Areas to receive concrete are free of debris and excess water.
5. Conveying equipment is clean and properly operating.
6. The required design mix is provided.
7. Concrete placement is performed in conformance with this Section.
8. Curing is performed in conformance with this Section.
9. Verification of concrete strength before form removal.

G. Evaluation of Mixture Designs

1. The adequacy of the mixture design to produce the minimum specified strength and durability shall be confirmed by testing batches. Slump shall not exceed the slump proposed for the work. Water cure the castings for 7 days.

2. Test the concrete as follows:
   a. Concrete testing shall comply with ACI-318. Test reports shall be submitted to the Engineer for review.
   b. Slump in accordance with ASTM C 143.
   c. Air content in accordance with ASTM C 231 or ASTM C 173.

d. Unit weight in accordance with ASTM C 138.
e. For strength, cast 6 by 12 inch cylinders in accordance with ASTM C 31/C 31M.

3. Test 6 by 12 inch cylinders cast under subparagraph 2 above as follows:
   a. Measure and weigh each specimen to determine unit weight as they are stripped from the molds.
   b. Test specimens to be tested at each age for pulse velocity through concrete in accordance with ASTM C 597.
   c. Two at each age of 24 hours and 3 and 7 days in accordance with ASTM C 39.
   d. Three at each age of 28, 56, and 90 days in accordance with ASTM C 39.
   e. Two at each age of 28 and 90 days in accordance with ASTM C 496.
4. Sampling and determination of water-soluble chloride ion content in accordance with ASTM C 1152. Maximum acid soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits of Table 3.8-1 below.
5. Sampling and determination of chloride ion penetration (ponding test) in accordance with AASHTO T259.

Table 3.8-1

Maximum Chloride Ion Content for Corrosion Protection

Member Type	Maximum acid-soluble chloride ion (C1) in concrete, percent by weight of cement
Cast in place/Precast Concrete	0.10

6. Submit test results for evaluation and acceptance.

H. Sampling

1. ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31 for making test specimens.
2. Sample concrete on a random basis except where a batch appears to be deficient and the test can be used to verify the observed deviation. Identify samples taken in a manner that they can be segmented from other tests. Obtain at least one sample for each 100 cubic yards, or fraction thereof, of each design mixture of concrete placed in any one day. When the total quantity of concrete with a given design mixture is less than 50 cubic yards, the strength tests may be waived by WETA's Representative, if in his judgment, adequate evidence of satisfactory strength is provided.

I. Testing

1. Slump Tests
   a. ASTM C 143. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved high range water reducing (HRWR)` admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 10 cubic yards (maximum) of concrete.

2. Temperature Tests
   a. Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions below 50 degrees F and above 80 degrees F for each batch (minimum) or every 10 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.
   b. Determine temperature of each composite sample in accordance with ASTM C 1064. When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 39 degrees F for more than 3 successive days, concrete shall be delivered to meet the following minimum temperature at the time of placement:
      1) 55 degrees F for sections less than 1 foot in the least dimension
      2) 50 degrees C for sections 1 to 3 feet in the least dimension
      3) 45 degrees C for sections 3 to 6 feet in the least dimension
      4) 40 degrees C for sections greater than 6 feet in the least dimension
   c. The minimum requirements may be terminated when temperatures above 50 degrees F occur during more than half of any 24 hour duration. The temperature of concrete at time of placement shall not exceed 86 degrees F.

3. Compressive Strength Tests
   a. ACI 214 tests for strength - conduct strength tests of concrete during construction in accordance with the following procedures:
      1) Mold and cure six 6 by 12 inch cylinders from each sample taken in accordance with ASTM C 31. Prevent evaporation and loss of water from the specimen.
      2) Test cylinders in accordance with ASTM C 39. Test one cylinder at 3 days, two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. The compressive strength test results for acceptance shall be the average of the compressive strengths from the two specimens tested at 28 days. If one specimen in a test shows evidence of improper sampling, molding or testing, discard the specimen and consider the strength of the remaining cylinder to be the test result. If both specimens in a test show any defects, WETA's Representative may allow the entire test to be discarded.
      3) Evaluate compressive strength test results at 28 days in accordance with ACI 214 using a coefficient of variation of 10 percent. Evaluate strength of concrete by averaging test results of each set of standard cylinders tested at 28 days. Not more than 10 percent of individual cylinders tested shall have a compressive strength less than the minimum 28-day compressive strengths stated in contract documents.
      4) If the average of any three consecutive strength test results is less than the specified strength (f'c) or the minimum test strength (fcr) for durability, whichever is higher, by more than 430 psi, take a minimum of three core samples in accordance with ASTM C 42, from the in-place work represented by the low-test results. Locations represented by erratic core strengths shall be retested. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes

with non-shrink grout. Match color and finish of adjacent concrete.

5) Strength test reports shall include location in the work where the batch represented by a test was deposited, batch ticket number, time batched and sampled, slump, air content (where specified), mixture and ambient temperature, unit weight, and water added on the job. Reports of strength tests shall include detailed information of storage and curing of specimens prior to testing.

6) Final reports shall be provided within 7 days of test completion.

4. Air Content
   a. ASTM C 173 or ASTM C 231 for normal weight concrete. Make air content tests on samples from the first three batches in the placement and until three consecutive batches have air contents within the range of the specified air content, at which time test every fifth batch. Maintain this test frequency until a batch is not within the specified range at which time resume testing of each batch until three consecutive batches have air contents within the specified range. Perform additional tests as necessary for control. Take air content tests from planned composite samples or from samples taken in accordance with ASTM C 172 at the point of concrete placement.

5. Chloride Ion Concentration
   a. ACI 318/318M. Determine water soluble chloride ion concentration. Perform test once for each mix design.

6. Non-Destructive Tests
   a. Non-destructive tests use of the rebound hammer in accordance with ASTM C 805, ASTM C 597, or other non-destructive processes may be permitted by WETA's Representative in evaluating the uniformity and relative concrete strength in place, or for selecting areas to be cored.
   b. Evaluate and validate test results conducted on properly calibrated equipment in accordance with standard ASTM procedures indicated.

7. Core Tests
   a. Obtain and test cores in accordance with ASTM C 42. If concrete in the structure is dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before testing and test dry. If concrete in the structure will be more than superficially wet under service conditions, test the cores, after moisture conditioning, in accordance with ASTM C 42.
   b. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Impair the strength of the structure as little as possible. If, before testing, cores show evidence of having been damaged subsequent to or during removal from the structure, take replacement cores.
   c. Fill core holes with non-shrink grout.
   d. WETA's Representative will evaluate and validate core tests in accordance with the specified procedures. Before testing in compression, test each core to determine pulse velocity through

concrete in accordance with ASTM C 597. Correlate pulse velocity of concrete cores with pulse velocity of in-place concrete.

J. Acceptance of Concrete Strength

1. Standard Molded and Cured Strength Specimens
   a. When the averages of all sets of three consecutive compressive strength test results equal or exceed the design compressive strength (f'_c) or the required field test strength (f_{cr}) whichever is higher, and no individual strength test falls below the specified compressive strength (f'_c) or the required field durability strength (f_{cr}) by more than 430 psi, whichever is higher. These criteria also apply when accelerated strength testing is specified unless another basis for acceptance is specified.
2. Non-Destructive Tests
   a. Non-destructive tests may be used when permitted to evaluate concrete where standard molded and cured cylinders have yielded results not meeting the criteria.
3. Core Tests
   a. When the average compressive strengths of the representative cores are equal to at least 85 percent of the design strength (f'_c) or the required average test strength (f_{cr}), whichever is higher, and if no single core is less than 75 percent of the specified strength (f'_c) or the required average field test strength (f_{cr}), whichever is higher, strength of concrete is satisfactory.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1. All steel elements shall be designed with the intent of achieving a 50-year minimum design life.

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

The work of this section consists of fabricating and installing structural steel components for the Vallejo Ferry Terminal Reconfiguration Project including but not limited to the steel float modifications, float guide pile collars, float hatches, temporary gangway support dolphin framing and associated steel accessories as shown on the construction drawings.

1.3 RELATED SECTIONS

1. Section 35 50 00 – STEEL FLOAT

Steel float work will be divided between the Fabricator and Contractor. See specification section 35 50 00 STEEL FLOAT for additional information including the complete design and construction responsibilities of the Fabricator and Contractor (with respect to the float).

1. Section 09 97 13 – STEEL COATINGS
2. Section 31 62 16 – STEEL PIPE PILES

1.4 REFERENCES

The latest edition of 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.

A. American Institute of Steel Construction (AISC)

1. AISC 201 Certification Program for Structural Steel Fabricators

2. AISC 303 Code of Standard Practice for Structural Steel Buildings and Bridges
3. AISC 317 Manual of Steel Construction, Volume II Connections
4. AISC 325 Steel Construction Manual, 15th ed.
5. AISC 326 Detailing for Steel Construction
6. AISC 360 Specification for Structural Steel Buildings

B. American Petroleum Institute (API)
1. API 5L Specification for Line Pipe

C. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code.
2. AWS D1.6 Structural Welding Code – Stainless Steel

D. American Society for Testing and Materials (ASTM)

1. ASTM A36 Standard Specification for Structural Steel
2. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
4. ASTM A131 Structural Steel for Ships
5. ASTM A143 Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
6. ASTM A153 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware
7. ASTM A182 Standard Specification for Forged or Rolled Alloyand Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
8. ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
9. ASTM A240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
10. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes
11. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
12. ASTM A479 Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels

13. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
14. ASTM A521 Standard Specification for Steel, Closed-Impression Die Forgings for General Industrial Use
15. ASTM A563 Standard Specification for Carbon and Alloy Steel Nuts
16. ASTM A572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
17. ASTM A653 Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
18. ASTM A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
19. ASTM A959 Guide for Specifying Harmonized Standard Grade Compositions of Wrought Stainless Steels
20. ASTM A992 Specification for Structural Steel Shapes
21. ASTM F436 Standard Specification for Hardened Steel Washers
22. ASTM F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
23. ASTM F594 Standard Specification for Stainless Steel Nuts
24. ASTM F844 Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
25. ASTM F1554 Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
26. ASTM F3125 Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Society of Mechanical Engineers (ASME)

1. ASME B18.21.1 Washers: Helical Spring-Lock, Tooth Lock, and Plan Washers

1.2 SYSTEM DESCRIPTION

Provide the structural steel system complete and ready for use. Structural steel systems including materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC 317 and AISC 325.

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings showing all materials, member shapes and sizes, dimensions, quantities, connection details, and accessories.

2. Shop Drawings shall be provided for all specially fabricated items, and catalog sheets for all standard manufactured items.

B. Manufacturers Product Data: Submit product data for welding electrodes and rods.

C. Certificates: Submit certification from manufacturers, suppliers, fabricators, et al. attesting that the following materials conform to the agreement requirements:

1. Steel
2. Bolts, Nuts, and Washers
3. Fasteners
4. Galvanizing
5. Pins and Rollers
6. Welding Electrodes and Rods
7. Welding Procedures and Qualifications
8. AISC Quality Certification
9. Coating System (per Section 09 97 13 - STEEL COATINGS)

1.4 CERTIFICATIONS

A. Welding Procedures and Qualifications

1. Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualifications tests. If the qualification date of the welding operator is more than one year old, the welding operator’s qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.
2. Conform to all requirements specified in AWS D1.1/D1.1M.

B. AISC Quality Certification: Submit certification for work fabricated in an AISC Certified Category Standard fabrication plant.

1.5 QUALITY ASSURANCE

A. Fabrication Drawing Requirements: Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Fabrication drawings must not be reproductions of Contract Drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 standard welding symbols. Any deviations from the details shown on the contract drawings must be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the Contract Drawings.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. Carbon Steel: All steel shall be coated unless it is galvanized or stainless steel. All galvanized or stainless items are noted on the drawings or in the specifications.

1.	ASTM A36	Float keel, side, end, deck and bulkhead plating
2.	ASTM A572, Grade 50	Steel plate, unless noted otherwise
3.	ASTM A572, Grade 50	Shackle lugs, padeyes, and other steel plate per drawings
4.	ASTM A572, Grade 50	Channels and Angles
5.	ASTM A53 Grade B	Pipe
6.	ASTM A500 Grade C	Rectangular and round HSS
7.	ASTM A992, A690, or A572 Grade 50	Wide Flange Shapes, Tees

B. Stainless Steel:

1.	ASTM A276, Type 316	Stainless steel plates and shapes

2.2 STEEL WELDS

A. Carbon Steel

1. Welding Electrodes and Rods: AWS D1.1/D1.1M, Minimum quality: E70XX
2. Welded Shear Stud Connectors: ASTM A29/A29M, Type B; AWS D1.1/D1.1M

B. Stainless Steel

Welding Electrodes and Rods: AWS D1.6/D1.6M

2.3 BOLTS, NUTS, AND WASHERS

A. Carbon Steel

1. Bolts between steel components shall conform to ASTM F3125, hot-dip galvanized; and where exposed, shall be of the same color and finish as the metal to which applied. Grade A325 unless noted otherwise.
2. Anchor bolts and thru bolts shall conform to ASTM F1554, hot-dip galvanized.
3. Nuts shall conform to ASTM A563, hot-dip galvanized.
4. Washers shall conform to ASTM F436, hot-dip galvanized.

B. Stainless Steel

1. Stainless steel bolts and threaded studs shall conform to ASTM F593, Alloy Designation 316, Condition CW.

2. Stainless steel nuts shall conform to ASTM F594, Alloy Designation 316, Condition CW.

3. Stainless steel washers shall be made from the same stainless steel alloy type as the associated bolt/threaded stud/nut. Washer dimensional tolerances shall conform to ASME B18.21.1.

C. Dissimilar Materials: Washers and sleeves fabricated from MICARTA or G10 (or equivalent) shall be used to isolate dissimilar metals.

2.4 PINS: All pins shall be ASTM A182, Type F61.

PART 3 - EXECUTION

3.1 FABRICATION

A. All work shall conform to the approved Shop Drawings, Construction Drawings and this specification. Construction details, finishing details and colors shall be consistent throughout. Work shall be accurately set to established lines and elevations and securely fastened in place. Cutting, drilling, and punching shall produce clean true lines and surfaces. Exposed surfaces of work shall have a smooth finish.

B. Fabrication shall be in accordance with the applicable provisions of AISC 325. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under AISC 201-16.

C. Structural steelwork shall be prepared for painting in accordance with (endorsement "P" of AISC 201-16) and primed with the specified paint. See Contract Specification Section 09 97 13 – STEEL COATINGS.

D. Shop splices of members will be permitted only where indicated on the Construction Drawings. Splices not indicated require the approval of WETA's Representative.

E. Adequate drainage holes must be drilled to eliminate water traps. Hole diameter must be 1/2 inch minimum, and location must be indicated on the shop drawings.

F. Seal ends of HSS or pipe structural members with cover or end plates.

3.2 STORAGE

A. Material shall be stored in such a manner and location to minimize possibility of deterioration or damage.

3.3 CONNECTIONS

A. Do not tighten anchor bolts set in concrete with impact torque wrenches.

B. Punch, sub-punch and ream, or drill bolt and pin holes perpendicular to the surface of the member.

C. Holes shall not be cut or enlarged by burning.

D. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.4 GAS CUTTING

A. Use of gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing.

B. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from WETA's Representative.

3.5 WELDING

A. Provide AWS D1.1/D1.1M qualified welders, welding operators and tackers. The Contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding; including welding done using prequalified procedures.

B. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

C. Parts to be welded shall be free of dirt, grease, and other contaminants, and shall fit up properly for sound welding. Surfaces to be welded shall not be cut with oxygen. Sawing, shearing, or machining may be used.

D. Temporary welds, run-off plates, and backing strips shall be removed from exposed surfaces and ground smooth.

3.6 FINISHING

A. All exposed carbon steel elements shall be galvanized or painted as described in Contract Specification Section 09 97 13 – STEEL COATINGS, except walking surfaces.

B. Painting: Paint colors are specified in Contract Specification Section 09 97 13 – STEEL COATINGS.

3.7 GALVANIZATION

A. All steel that is not coated or stainless steel shall be galvanized.

B. Galvanize steel members, fabrications, and assemblies after fabrication by the hot- dip process in accordance with ASTM A123 / 123M.

C. Galvanize bolts, nuts, washers and iron and steel hardware components in accordance with ASTM A153 / 153M.

D. Safeguard products against steel embrittlement in conformance with ASTM A143.

E. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

F. Thoroughly clean surfaces of rust, scale, grease, and foreign matter prior to galvanizing.

G. Galvanize after fabrication where practicable.

H. Galvanizing Repair

1. Repair damage to galvanized coatings using ASTM A780/A780M zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting.

2. Galvanized items that have been damaged shall be thoroughly cleaned and recoated using the galvanizing repair paint specified.

3. The coating shall be applied according to manufacturer's recommendations and have a combined dry film thickness of not less than six (6) mils.

4. Do not heat surfaces to which repair paint has been applied.

3.8 WELD TESTS

A. Visual Inspection

1. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect 100% of the welds and mark welds, including fillet weld end returns.

B. Nondestructive Testing

1. Test locations shall be selected by WETA's Representative. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by WETA's Representative. When all welds made by an individual welder are required to be tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

C. Test Frequency

Weld Type	Test Type	Connections to be Tested
Groove Weld	Ultrasonic	100%
Fillet Weld	Magnetic Particle	20%

END OF SECTION

SECTION 05 51 35

APPROACH WAY and GANGWAY

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

A. This work includes the requirements for design, furnishing and installing the approach way and gangway. The following items are included within the scope of this specification.

1. Approach way

2. Gangway

1.3 RELATED SECTIONS

1. Section 35 50 00 – STEEL FLOAT

2. Section 06 73 01 – FIBERGLASS REINFORCED PLASTIC GRATING

1.4 REFERENCES

A. 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.

1. AMERICAN WELDING SOCIETY (AWS)
   a. AWS D1.2/D1.2M, (2014) Structural Welding Code - Aluminum

2. ASTM INTERNATIONAL (ASTM)
   a. ASTM B 211, (2012) Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire

   b. ASTM B 308/B 308M,(2010) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles

c. ASTM A 391/A 391M, (2012) Standard Specification for Grade 80 Alloy Steel Chain

d. ASTM D 6712, (2017) Standard Specification for Ultra-High-Molecular-Weight Polyethylene (UHMW-PE) Solid Plastic Shapes

3. CALIFORNIA BUILDING CODE (CBC)

a. (2016) California Building Code

4. AMERICAN DISABILITY ACT (ADA)

a. (2010) Standards and Specifications

1.5 SYSTEM DESCRIPTION

A. Design Requirements

1. Design of the approach way shall conform to CBC (latest edition) and ADA requirements. In addition, the approach way and gangway system for this project shall conform to the following criteria:

a. Span and clear walkway width shall be as shown on the drawings.

b. Clear walking width shall be measured as the clear distance between handrails.

c. Guardrail shall be provided.

d. Handrail shall conform to CBC.

2. Kick Plate

a. Provide kick plates at base of each guardrail, 4 inches tall.

3. Structural Design

a. The approach way and gangway, and associated connections shall be designed to meet the performance criteria set forth in the Drawings. The following shall also be considered part of the performance criteria.

b. Handrails and Guardrails

i. 50 pounds per lineal foot horizontal Live Load applied to the full length of the gangway on both sides simultaneously, per CBC.
ii. 100 pounds per lineal foot vertical Live Load, not concurrent with the horizontal uniform load.
iii. 250 pounds concentrated live load not concurrent with uniform load.

c. Member Design

i. Structural components shall be designed with minimum safety factor in accordance with Aluminum Association "Specifications for Aluminum Structures: Bridge Type Structures, 1.3.2." Analysis of truss shall utilize Holt's

method for determining top chord buckling as outlined in "Guide to Stability Design Criteria for Metal Structures," 4th Edition, by Theodore B. Galambos.

1.6 SUBMITTALS

A. The following shall be submitted according to submittal procedures:

1. Shop Drawings

a. Prior to fabrication of approach way and gangway, submit shop drawings to WETA's Representative for review. Shop drawings shall show the materials, member shapes, sizes, and locations, dimensions, layout of the non-structural members, details of all connections, hinges, decking, plates, pipe supports, electrical isolation, clamping for utilities, electrical, layout of utilities supported by the gangways, ramps, or landings and all other details necessary and pertinent to fabrication and installation.

2. Product Data

a. Submit data sheets for all materials and products to be fabricated and installed under this section. Catalog cuts and loading charts shall be provided for decking information.

3. Design Data

a. Submit all design criteria, drawings, and calculations to WETA's Representative for review. Calculations and drawings shall be sealed by and prepared under the direction of a Registered Professional Engineer licensed in the State of California.

4. Test Reports

a. Submit all test reports and mill certificates to WETA's Representative for review. Test reports and certificates shall substantiate the required mechanical properties of the materials utilized.

5. Manufacturer's Instructions

a. Submit all manufacturer's manuals and maintenance literature to WETA's Representative.

6. As-Built Drawings:

a. Submit as-built versions of all drawings after final installation and acceptance of the equipment by WETA's Representative.

1.7 QUALITY ASSURANCE

A. Qualifications of Fabricator and Welders

a. The fabricator of the metals specified in this section shall be experienced in the fabrication and working of metals, including cutting, bending, forming, and finishing. Welders shall be currently certified in accordance with AWS D1.2/D1.2M, submit qualification test reports, and bearing witness certification of

independent laboratory and inspection service approved by WETA's Representative. If welder has not been engaged in welding process for three or more months, requalify before permitting them to do structural welding Work.

B. Experience

1. The approach way and gangway manufacturer must be regularly engaged in the design and fabrication of aluminum structures and shall show proof of having successfully completed a minimum of ten similar projects within the last three years.

C. Qualifications of Workers

1. Provide sufficient supervisors and skilled workers who shall be thoroughly familiar with the type of construction involved and the techniques required for the proper execution of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Use all means necessary to protect this work before, during, and after installation and protect the installed work of other trades. In the event of damage, immediately make all repairs and replacements necessary and at no additional cost to WETA.

PART 2 - PRODUCTS

2.1 GENERAL

A. The approach way and gangway shall be aluminum. All materials shall be new and meet all acceptable industry standards and manufacturers' recommendations.

2.2 ALUMINUM

A. Use aluminum alloy. All edges shall be smooth and free of sharp edges.

2.3 POLYETHYLENE

A. Use UHMW-PE for all rollers, bushings, edge strips, and dielectric isolators in gangway manufacture. UHMW-PE parts shall be black and ultraviolet stabilized.

B. Use UHMW-PE or approved equivalent for dielectric isolators between the aluminum landing post base plates and the steel plates used to mount the landings to the ferry float. UHMW-PE parts shall be black and ultraviolet stabilized.

C. UHMW-PE shall be in accordance with ASTM D6712.

2.4 WELDS

A. Use a filler metal alloy for welds to produce a weld compatible with base structural metal for corrosion resistance in accordance with AWS D1.2/D1.2M. All connections to be welded shall be of new material, clean and free of any contaminants. All joints shall fit properly and be prepared for the appropriate weld as described in the shop drawings.

2.5 WALKING SURFACES

A. Walking surface shall have a permanent aggressive non-skid finish.

1. Walking surfaces of gangway and approach way structure to be fiberglass grating, see specifications Section 06 73 01 - FIBERGLASS REINFORCED PLASTIC GRATING.

2. Walking surfaces on existing float platforms, ramps and adjustable ramps to confirm to Section 06 73 01 - FIBERGLASS REINFORCED PLASTIC GRATING, Subsection 2.5.

B. Fasteners

1. Stainless steel 316 clips, suitable for use with fiberglass pultruded grating. Hardware shall be recessed below grating surface. Fastener that extends to the top of the fiberglass grating are to be nearly flush with the walking surface. Fastener material to be provided with nonskid coating if placed on the walking surface. Fasteners shall be isolated in accordance with Subsection 3.6 Dissimilar Metals.

C. Walkway Transitions

1. Walking surface shall have a yellow warning stripe at all transitions, 4” minimum width. All transition gaps shall be less than two (2) inches.

2.6 SAFETY CHAINS

A. Approach way and gangway to be provided with Safety Chains at hinged end to support weight of the structure.

B. ASTM 391 Grade 80 Alloy Steel Chain.

2.7 LIGHTING

A. All approach way, gangway, and reinstalled float platforms, ramps and adjustable ramps railing shall have integral, California Building Code-compliant, LED egress lighting. See Division 26.

2.8 PIPE AND CONDUIT SUPPORTS

A. Shall be aluminum. Fasteners shall be isolated in accordance with Subsection 3.5 Dissimilar Metals.

2.9 THROW RAMPS

A. Reuse the existing five (5) throw ramps for the ferry Landing.

2.10 PLATFORM STAIRS

A. Existing float platform stairs on WETA Standard Float to be removed, protected in place and reinstalled after completion of maintenance of the float.

2.11 PLATFORMS, RAMPS AND ADJUSTABLE RAMPS

A. Existing platforms, ramps, and adjustable ramps on WETA Standard Float to be removed, protected in place and reinstalled after completion of maintenance on the float.

2.12 ALUMINUM CANOPY

A. Approach way and gangway to be provided with aluminum canopy. Movement of elements to be considered when designing interface between components.

PART 3 - EXECUTION

3.1 UTILITIES ATTACHMENTS

A. Attach utilities to underside of approach way, gangway and reinstalled float platforms, ramps, and adjustable ramps by welding aluminum "Uni-Strut".

3.2 TRANSITION PLATES

A. Full-width, hinged aluminum transition plates designed to operate smoothly through the full range of movement of the structure shall be provided at each end.

B. The length shall be as required to provide ADA path of travel for all tide ranges. The leading edge of each transition plate shall be UHMW that has been profiled to create no more than 1/4- inch vertical rise. Transition plates shall have arc-sprayed "Thermion" Ceramic Core TH604 anti- skid aluminum garnet traction coating or equal.

C. The transition plate attachment to the approach way and gangway shall be designed, fabricated, and installed to carry full dead load plus live load.

3.3 APPROACH WAY SUPPORT AT LANDSIDE

A. The approach way shall be supported on the pile supported concrete cap by low friction roller wheels or UHMW pads to support the vertical reaction and bearing plates. The support is to accommodate the full range of movement of the approach way loading under seismic and temperate conditions.

3.4 APPROACH WAY SUPPORT AT FLOAT PLATFORM END

A. The gangway end of the approach way shall be supported on the pile supported concrete cap platform by low friction roller wheels to support the vertical reaction and bearing plates. A pin shall be provided to allow horizontal rotation and pivoting of the approach way with seismic and temperature displacements. The pins shall be isolated from any dissimilar metal contact with UHMW bushings and washer.

3.5 GANGWAY SUPPORT AT FLOAT END

A. The float end of the gangway shall be supported on UHMW sliders. Gangway sliders shall remain in contact with the tracks on the support frame at all times. Gangway slider assembly shall incorporate stainless steel Zerk grease fittings. Grease to the Zerk fittings shall provide lubrication to the slider rotation axles via drilled grease passage ways. The gangway shall be designed to withstand float motions including a vertical change in float

elevation due to water level fluctuation and horizontal drift and roll motions without structure interference or overstress, including fatigue of gangway members and supports. The gangway support landing shall be fitted with guides placed under each gangway slider and stops at the limits of travel. The gangway support system on the float end shall be modified and detailed as required to allow both rotation about the gangway axis and translation and shall accommodate seismic displacement and translation of the monopile concrete cap platform.

3.6 GANGWAY SUPPORT AT PLATFORM END

A. The approach way end of the gangway shall be supported on the pile supported concrete cap platform by low friction roller wheels to support the vertical reaction and bearing plates. A pin shall be provided to allow horizontal rotation and pivoting of the gangway with varying tide levels and seismic displacements. The pins shall be isolated from any dissimilar metal contact with UHMW bushings and washers.

3.7 DISSIMILAR METALS

A. Dissimilar metals shall be isolated to inhibit galvanic corrosion.

3.8 FABRICATION AND WORKMANSHIP

A. Design, fabrication, delivery, handling and installation of the approach way, gangway, and reinstalled float platforms, ramps and adjustable ramps shall conform to the latest revisions of the aluminum construction manual and all applicable standards and data as described by the Aluminum Association. Fabricate approach way and gangway in accordance with the approved shop drawings. Edges shall be cut true, smooth and free from burrs. Corner edges shall be ground smooth. Drill or punch all holes required for the attachment of other trades and for bolted connections. Weld splatters, burrs and weld flash shall be removed from all exposed surfaces.

B. Materials delivered and stored at the manufacturing facility shall be properly marked and inventoried on vertical racks located in a lockable conditioned warehouse.

C. Completed approach way, gangway, and reinstalled float platforms, ramps, and adjustable ramps, transition plates shall be stored on dunnage or by other appropriate means to prevent direct contact with the ground and unnecessary damage. Completed approach way and gangway shall bear an identification decal showing the date of manufacture, live load capacity and the identifying serial number. The approach way and gangway shall be directly traceable to the manufacturer.

D. Job files for the approach way and gangway shall be kept for 12 years beyond substantial completion of the project, holding all information including shop drawings, submittals, material purchase orders, as-built shop drawings, material certifications for all components, shipping information and any correspondence.

3.9 INSTALLATION

A. Prior to installation of approach way, gangway and reinstalled float platforms, ramps, and adjustable ramps, carefully inspect the installed work of other trades affecting this work and verify that all such work is complete to the point where this installation may commence properly.

B. Install approach way, gangway, and reinstalled float platforms, ramps, and adjustable ramps in accordance with the Project Drawings and approved shop drawings. Alignment shall be straight and true.

C. Adjust hinges and transition plate connections as necessary for a complete and operable installation.

END OF SECTION

SECTION 06 73 01

FIBERGLASS REINFORCED PLASTIC GRATING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design/Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design-Builder.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 GENERAL

A. This section includes shop fabricated fiberglass reinforced plastic (FRP) deck gratings and associated hardware for the approach way and gangway.

1.3 REFERENCES

A. 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.

1. ASTM International (ASTM)

a. ASTM D 635 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.

b. ASTM E 84, (2010) Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 DESCRIPTION

A. The Contractor shall furnish, fabricate (where necessary), and install all FRP items, with all appurtenances, accessories and incidentals necessary to produce a complete, operable and serviceable installation as shown on the Contract Drawings and as specified herein, and referenced as decking in Section 05 51 35 – APPROACH WAY and GANGWAY in accordance with the requirements of the contract documents.

1.5 SUBMITTALS

A. The following shall be submitted according to submittal procedures:

1. The contractor shall submit the manufacturer's published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, anchor systems and their allowable load tables, percent open area calculations and design calculations for systems not sized or designed in the contract documents.

2. The contractor shall submit a 1 sq. ft. sample piece of each item specified herein for acceptance by WETA's Representative as to quality and color. Sample pieces shall be manufactured by the method to be used in the work.

3. The contractor shall submit a sample of the attachment hardware for acceptance by WETA's Representative.

1.6 QUALITY ASSURANCE

A. All items to be provided under this Section shall be furnished only by manufacturers who have experience in the design and manufacture of similar products and systems. A record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall demonstrate experience.

B. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

C. Fabricator Qualifications

1. Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

1.7 DESIGN CRITERIA

A. The design criteria of the FRP products including connections shall be in accordance with governing building codes and generally accepted standards in the FRP industry.

B. Gratings and Structures

1. Design live loads of the FRP gratings for walkway applications shall be 100 psf uniformly distributed load with a maximum deflection of L/360.

C. Gratings shall also resist a design concentrated load of 400 lbf over a 6"x6" area.

1.8 PRODUCT DELIVERY AND STORAGE

A. All gratings and components shall be shop fabricated.

B. Delivery of Materials

1. Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

2. Storage of Products

a. All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities at a temperature between 70- and 85-degrees F until they are required.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Floor Grating shall be 1-Inch-Deep Micro-Mesh® as manufactured by or approved equal for approach way and gangway:

Fibergrate Composite Structures Inc. 5151 Belt Line Road, Suite 1212 Dallas, Texas 75254-7028 USA (800) 527-4043 (972) 250-1530 Fax
Website: www.fibergrate.com E-mail: info@fibergrate.com

2.2 GENERAL

A. All FRP items under this Section shall be composed of fiberglass reinforcements and resins in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering with no evidence of fiber orientation irregularities, interlaminar voids, porosity, resin rich or resin starved areas.

C. All grating clips and hardware shall be manufactured of type 316SS. After fabrication, all cut ends, holes and abrasions of FRP gratings or systems shall be sealed with a resin comparable to the grating panel or structural system. Grating clips shall be isolated from the structural system in accordance with Section 05 51 35, 3.5 DISSIMILAR METALS.

2.3 FRP GRATING

A. Grating shall be fire-retardant with tested flame spread ratings of 25 or less when tested in accordance with the ASTM E 84 Tunnel Test. Test data shall be from full scale testing of actual production grating of the same type of material supplied on the project. Test data performed only on the base resin shall not be acceptable.

B. Depth: One (1) inch minimum

C. Manufacture

1. Grating shall be of a one-piece molded construction for maximum corrosion resistance. Grating shall have a square mesh pattern providing bidirectional strength and maximum impact resistance.

D. Resin System

1. Type GPI, manufactured of an isophthalic polyester resin system suitable for constant contact with salt water and exposure to a variety of environmental conditions and temperatures. Color shall be light gray.

E. Mesh Configuration

1. Minimum one (1) inch-deep square mesh with 3/4 inch square mesh inlay in top surface. Actual openings of mesh shall not exceed 1/2 inch in width to provide for optimal non-slip footing and to prevent tools and debris from falling through the grating. Openings in grating shall exceed 30 percent of the gross area including all supports. Openings over supports shall not be included in the 30 percent.

F. Non-Slip Surfacing

1. Grating shall be manufactured with a silica grit applied to the top surface for maximum slip resistance.

2.4 GRATING FABRICATION

A. Measurements: Grating supplied shall meet the dimensional requirements and tolerances as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. When field dimensions are not required, contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

B. Layout: Each grating section shall be readily removable, except were indicated on drawings. Manufacturer to provide openings and holes were located on the contract drawings. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.

C. Sealing: All shop fabricated grating cuts shall be sealed to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

D. Hardware: For panels installed on structural members, Type 316 stainless steel hold-down clips shall be provided, with a minimum of four per piece of grating, or as recommended by the manufacturer. Clips and hardware are to be recessed to prevent trip hazard.

2.5 ADDITIONAL NON-SLIP SURFACE

The existing platforms, ramps, and adjustable ramps on the float are to be provided with new non- slip surface. Options for non-slip surface include:

A. Nonslip plates shall be equivalent to molded "Grid Plates", as manufactured by SLIPNOT, 2545 Beaufait St, Detroit MI. (800) 754-7668, fax (313) 923-4555

B. Nonslip sheets shall be equivalent to "Anti Slip Fiberglass RFP Sheet", as manufactured by WATCO Industry Flooring, 11 Hawthorn Parkway Vernon Hills, IL. (855) 627-6350, email: info@watcofloors.com

C. WETA approved equivalent non-skid system.

PART 3 - EXECUTION

3.1 GENERAL

A. Measurements

1. FRP gratings supplied shall meet the dimensional requirements and tolerances as shown or specified. The contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by manufacturer to complete the work. When field dimensions are not required, Contractor shall determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

B. Sealing

1. All shop fabricated cuts, drilled holes, etc. shall be coated with compatible resin to provide maximum corrosion resistance and product life. All fabricated cuts, drilled holes etc., shall be coated similarly by the Contractor in accordance with the manufacturer's instructions.

C. Hardware

1. Grating hold down clips shall be attached to the supporting structure per manufacturer's recommendation to fully penetrate the structural supports.

3.2 INSTALLATION

A. Contractor shall install FRP materials in accordance with manufacturer's assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Overhead aluminum doors and frames.

B. Related Sections:

Section 08 71 00: DOOR HARDWARE
Section 08 71 13: AUTOMATIC DOOR OPERATORS

C. Codes and References: Comply with the version year adopted by the Authority having Jurisdiction.

1. U.S. Department of Justice, 2010 ADA standards for accessible design
2. California Building Code, current edition
3. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
4. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
5. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
6. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
7. ASTM A167-99: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
8. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
9. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
10. ANSI/DASMA 108 – Standard Method for Testing Sectional Garage Doors, Rolling Doors, and Flexible Doors; Determination of Structural Performance under Uniform Static Air Pressure Difference
11. ASCE 7/22 – American Society of Civil Engineers Minimum Design Loads and Associated Criteria for Buildings and Other Structures
12. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
13. ASTM D221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles, and Tubes
14. UL 325 – UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems
15. UL 674 – UL Standard for Safety Electric Motors and Generators for use in Hazardous Locations

1.2 QUALITY ASSURANCE

Source Limitations: Obtain overhead aluminum doors and frames through one source from a single manufacturer wherever possible.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in an adequately ventilated dry location that is free from dirt and dust, water, or other contaminants. Store in a manner that permits easy access for inspection and handling. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Provide installation drawings for door assemblies which show: elevations of each door type, shape and thickness of materials, finishes, details of joints and connections, details of guides and fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Show locations of replaceable fusible links on wiring diagrams for power, signal and controls.[For motor-operated doors include supporting brackets for motors, location, type, and ratings of motors, and safety devices.] Include a schedule showing the location of each door with the drawings
      - Overhead Coiling Doors
      - Counterbalancing Mechanism
      - Manual Door Operators
      - Electric Door Operators
      - Bottom Bars
      - Guides
      - Mounting Brackets
      - Hood
      - Installation Drawings

B. Product Data:
   1. Overhead Coiling Doors
   2. Hardware
   3. Counterbalancing Mechanism
   4. Manual Door Operators
   5. Electric Door Operators

C. Design Data:
   1. Overhead Coiling Doors
   2. Hardware
   3. Counterbalancing Mechanism
   4. Manual Door Operators
   5. Electric Door Operators

D. Operations and Maintenance Data
   1. Operations and Maintenance Manuals

E. Closeout Submittals
   1. Product Warranty

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 COORDINATION

A. Coordinate installation of anchorages for overhead steel door frames with aluminum bridge designer and manufacturer. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.7 WARRANTY

A. Provide manufacturer's written warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.

B. Furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship for not less than two years after completion and acceptance of the project.

C. Warrant that upon notification by the Owner, any defects in material, workmanship, and door operation are immediately correct within the same time period covered by the guarantee, at no cost to the Owner.

PART 2 - PRODUCTS

2.1 PRODUCT DESCRIPTION

A. Provide overhead coiling doors with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated. Doors must be spring counterbalanced, rolling type, and designed for use on exterior openings, as indicated. Doors must be operated by electric-power with auxiliary manual means of opening in case of power. Doors to be surface-mounted type with guides at jambs set back a sufficient distance to provide a clear opening when door is in open position.

B. Door specifications shall be submitted to Owner for review and approval.

C. WIND LOADING

Design and fabricate door assembly to withstand the applicable site specific wind loading in accordance with ANSI/DASMA 108. Provide test data showing compliance with ASTM E330/E330M. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested. Ensure that the complete assembly meets or exceeds the requirements of ASCE 7-22.

D. OPERATIONAL LIFE CYCLE

Design all portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue to operate through a minimum

number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

2.2 COMPONENTS

A. Overhead Coiling Doors

1. Curtain Materials and Construction

a. Provide curtain slats fabricated from aluminum sheets conforming to ASTM B209M ASTM B209, or ASTM B221M ASTM B221 extrusions, alloy and tempering standard from the manufacturer for type of use and finish indicated; with a thickness as required by the size of the door to meet the required wind load.

b. Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Ensure the provided slats are continuous without splices for the width of the door.

2. Non-Insulated Curtains

Form Curtains from the manufacturer’s standard shapes of interlocking slats.

3. Curtain Bottom Bar

Install curtain bottom bars as pairs of angles or using extrusions from the manufacturer's standard aluminum extrusions not less than 50 by 50 millimeter by 4.8 millimeter 2.0 by 2.0 inches by 0.188 inch. Use aluminum extrusions conforming to ASTM B221M ASTM B221.

4. Endlocks

Provide endlocks of Grade B cast steel conforming to ASTM A47/A47M, galvanized in accordance with ASTM A153/A153M. Secure locks at every other curtain slat. In addition to endlocks, exterior doors which have a design wind load of more than 20 pounds per square foot, must have windlocks of manufacturer's standard design. Windlocks must prevent curtain from leaving guide because of deflection from wind pressure or other forces.

5. Locking Devices

a. Ensure that the slide bolt engages through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

b. Provide a locking device assembly which includes cylinder lock, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

6. Safety Interlock

Equip power-operated doors with a safety interlock switch to disengage power supply when the door is locked, or provide an operator with an internal lock sensing device to prevent the door opening when the door is locked.

B. Hardware

Ensure that all hardware conforms to ASTM A153/A153M, ASTM A307, and ASTM F568M.

1. Guides

a. Fabricate curtain jamb guides from the manufacturer's standard angles or channels of same material and finish as curtain slats unless otherwise indicated. Provide guides with sufficient depth or incorporate a locking bar to retain the curtain in place under the wind pressure specified. Ensure curtain operates smoothly. Slot bolt holes for track adjustment. Securely attach guides to adjoining construction with not less than 3/8 inch diameter bolts, spaced near each end and not over 30 inches apart.

b. Ensure guides are structural grade, three angle assembly of aluminum to form a slot of sufficient depth to retain curtains in guides to achieve design windload standard. Guides may be provided with integral windlock bars and removable bottom bar stops.

c. Fabricate with aluminum angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Flare the top of inner and outer guide angles outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

2. Hood

Provide a hood with a minimum aluminum 18-gauge B&S sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. The hood encloses the curtain coil and counterbalance mechanism.

C. Counterbalancing Mechanism

1. Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted, around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

2. Brackets

a. Provide the manufacturer’s standard mounting brackets with one located at each end of the counterbalance barrel conforming to ASTM A36/A36M. Provide brackets of hot-rolled steel.

b. Brackets will be of 1/4 inch minimum thick steel plates, with permanently sealed ball bearings. Designed to enclose ends of coil and provide support of counterbalance pipe at each end.

3. Counterbalance Barrels

Curtain must roll up on a barrel supported at head of opening on brackets and be balanced by a torsion spring system in the barrel. Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M or equivalent. Ensure the barrel is of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats. Limit barrel deflection to not more than 0.03 inch per foot of span under full load.

a. Barrel

Provide steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.

b. Spring Balance

Provide an oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door. Ensure that effort to operate manually operated units does not exceed 25 lbs. At least 80 percent of the door weight must be counterbalanced at any position. Provide wheel for applying and adjusting spring torque.

4. Torsion Rod for Counterbalance

Fabricate rod from the manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

D. Manual Push-Up Door Operators

Provide lifting handles on both sides of door and counterbalance in a manner to provide easy operation while raising or lowering the curtain by hand. Adjust counterbalance mechanisms so that the required lift or pull for operation does not exceed 25 pounds unless another type of door operator is indicated. Provide pull-down straps or pole hooks on bottom rail of doors over 7 feet high.

E. Electric Door Operators

1. Provide electrical wiring and door operating controls conforming to the applicable requirements of NFPA 70 and UL 325. The door manufacturer must furnish automatic control and safety devices, including extra flexible type SO cable and spring-loaded automatic takeup reel or equivalent device, as required for proper operation of the doors.

2. Electric door-operator assemblies need to be the sizes and capacities recommended and provided by the door manufacturer for specified doors. Furnish complete assemblies with electric motors and factory-prewired

motor controls, starter, gear reduction units, solenoid-operated brakes, clutch, remote-control stations, manual or automatic control devices, and accessories as required for proper operation of the doors.

3. Design the operators so that motors may be removed without disturbing the limit-switch adjustment and affecting the emergency auxiliary operators.

4. Provide a manual operator of crank-gear or chain-gear mechanisms with a release clutch to permit manual operation of doors in case of power failure. Arrange the emergency manual operator so that it may be put into and out of operation from floor level, and its use does not affect the adjustment of the limit switches. Provide an electrical or mechanical device that automatically disconnects the motor from the operating mechanism when the emergency manual operating mechanism is engaged.

F. Electric Motors

1. Provide motors which are the high-starting-torque, reversible, constant-duty electrical type with overload protection of sufficient torque and wattage horsepower to move the door in either direction from any position. Ensure they produce a door-travel speed of not less than 8 nor more than 12 inches per second without exceeding the wattage horsepower rating.

2. Provide motors which conform to NEMA MG 1 designation, temperature rating, service factor, enclosure type, and efficiency to the requirements specified. Motors must be suitable for operation on current of the characteristics indicated. Motor enclosures must be the drip-proof type or NEMA TEFC and TENV type. Install motors in approved locations.

G. Motor Bearings

1. Select bearings with bronze-sleeve or heavy-duty ball or roller antifriction type with full provisions for the type of thrust imposed by the specific duty load.

2. Pre-lubricate and factory seal bearings in motors less than 1/2 horsepower.

3. Equip motors coupled to worm-gear reduction units with either ball or roller bearings.

4. Equip bearings in motors 1/2 horsepower or larger with lubrication service fittings. Fit lubrication fittings with color-coded plastic or metal dust caps.

5. In any motor, bearings that are lubricated at the factory for extended duty periods do not need to be lubricated for a given number of operating hours. Display this information on an appropriate tag or label on the motor with instructions for lubrication cycle maintenance.

H. Motor Starters, Controls, and Enclosures

1. Provide each door motor with: a factory-wired, unfused, disconnect switch; a reversing, across-the-line magnetic starter with thermal overload protection; 24-volt operating coils with a control transformer limit switch; and a safety interlock assembled in a NEMA ICS 6 type enclosure as specified herein. Ensure control equipment conforms to NEMA ICS 1 and NEMA ICS 2.

2. Provide adjustable switches, electrically interlocked with the motor controls and set to stop the door automatically at the fully open and fully closed position.

I. Control Enclosures

Provide control enclosures that conform to NEMA ICS 6 for oil-tight and dust-tight NEMA Type 12.

J. Transformer

Provide starters with 230/460 to 115 volt control transformers with one secondary fuse when required to reduce the voltage on control circuits to 24 volts or less. Provide a transformer conforming to NEMA ST 1.

K. Sensing-Edge Device

1. Provide each door with a pneumatic or electric sensing device that meets UL 325, extends the full width of the door, and is located within a U-section neoprene or rubber astragal, mounted on the bottom rail of the bottom door section. Device needs to immediately stop and reverse the door upon contact with an obstruction in the door opening or upon failure of the device or any component of the control system and cause the door to return to its user-defined open position. Any momentary door-closing circuit must be automatically locked out and the door must be operable manually or with constant pressure controls until the failure or damage has been corrected. A sensing device is not a substitute for a limit switch.

2. Connect sensing device to the control circuit through a retracting cord and reel.

L. Keyed Remote-Control Stations

1. Keyed remote control stations must be at least 5 feet above the floor line, and all switches must be located so that the operator will have complete visibility of the door at all times. Provide keyed remote control stations that are full-guarded, momentary-contact three-button, heavy-duty, surface-mounted NEMA ICS 6, Type 4 enclosures as specified. Mark buttons "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" buttons must be of the type requiring only momentary pressure to operate. The "CLOSE" button must be of the type either requiring constant pressure to maintain the closing motion of the door or momentary pressure when installed with a monitored entrapment detection device which, upon failure of the device or any component of the control system, cause the door to return to its full open position. When the door is in motion and the "STOP" button is pressed, ensure the door stops instantly and remains in the stopped position. From the stopped position, the door may then be operated in either direction by the "OPEN" or "CLOSE" buttons. When the door is in motion, and the "CLOSE" button of the constant pressure type is released, the door must stop and remain in the stop position or reverse to the user set up position; from the stop position, the door may then be operated in either direction by the "OPEN" or "CLOSE" buttons. Controls must be adjustable to automatically stop the doors at their fully open and closed positions. Open and closed positions must be readily adjustable.

M. Speed-Reduction Units

1. Provide speed-reduction units consisting of hardened-steel worm and bronze worm gear assemblies or planetary gear reducers running in oil or grease and inside a sealed casing, coupled to the motor through a flexible coupling. Drive shafts need to rotate on ball- or roller-bearing assemblies that are integral with the unit.

2. Provide minimum ratings of speed reduction units in accordance with AGMA provisions for class of service.

3. Ground worm gears to provide accurate thread form; machine teeth for all other types of gearing. Surface harden all gears.

4. Provide antifriction type bearings equipped with oil seals.

N. Chain Drives

1. Provide roller chains that are a power-transmission series steel roller type conforming to ASME B29.400, with a minimum safety factor of 10 times the design load.

2. Heat-treat or otherwise harden roller-chain side bars, rollers, pins, and bushings.

3. Provide high-carbon steel chain sprockets with machine-cut hardened teeth, finished bore and keyseat, and hollow-head setscrews.

O. Brakes

Provide 360-degree shoe brakes or shoe and drum brakes. Ensure the brakes are solenoid-operated and electrically interlocked to the control circuit to set automatically when power is interrupted.

P. Clutches

Ensure clutches are friction type or adjustable centrifugal type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

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

3.2 INSTALLATION

A. Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, ensure doors are free from all distortion.

B. Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the Contract Documents and as required by the manufacturer.

C. Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

3.3 ADJUSTING AND CLEANING

A. Acceptance Provisions

1. After installation, adjust the hardware and moving parts. Lubricate bearings and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

2. Engage a factory-authorized service representative to perform startup service and checks according to the manufacturer's written instructions.

3. Test the door opening and closing operation when activated by controls or alarm-connected fire-release system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset the door-closing mechanism after a successful test.

4. Test and make final adjustment of new doors at no additional cost to the Owner.

B. Maintenance and Adjustment

Not more than 90 calendar days after completion and acceptance of the project, examine, lubricate, test, and re-adjust doors as required for proper operation.

C. Cleaning

1. Clean doors in accordance with manufacturer's approved instructions.

END OF SECTION

SECTION 08 71 00

DOOR & GATE HARDWARE

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Overhead doors and swinging gates
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door & gate hardware.
2. Electromechanical door & gate hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Section 08 13 19: OVERHEAD STEEL DOORS AND FRAMES
2. Section 08 71 13: AUTOMATIC DOOR OPERATORS

D. Codes and References: Comply with the version year adopted by the Authority having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A156.78 – Door Controls – Overhead Stops and Holders
3. ICC/IBC - International Building Code.
4. NFPA 70 - National Electrical Code.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. CA State Building Codes, Including Local Amendments.
8. US Department of Justice, 2010 ADA standards for accessible design

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series

1.2 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door and Gate Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door and Gate Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.
   c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with WETA has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. WETA must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and WETA concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to WETA via registered mail or overnight package service. Instructions for delivery to WETA shall be established at the "Keying Conference".

1.5 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.6 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive WETA of other rights WETA may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by WETA. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Seven years for heavy duty cylindrical (bored) locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.
4. Five years for motorized electric latch retraction exit devices.
5. Two years for electromechanical door hardware.

1.7 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for WETA's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

All Selected hardware and related materials shall be appropriate for saltwater marine environment.

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, WETA, and their designated consultants.

2.2 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to 12 wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

2.3 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer’s Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by WETA..
3. New System: Key locks to a new key system as directed by WETA.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to WETA's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by WETA.

2.4 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.

1. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
2. Locks are to be non-handed and fully field reversible.
3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.
4. Acceptable Manufacturers:
   a. Corbin Russwin Hardware (RU) – CL3300 Series.
   b. Sargent Manufacturing (SA) – 10 Line.
   c. Or Equivalent

2.5 CAR READERS AND KEYPAD ACCESS CONTROL HARDWARE

Provide in accordance with ANSI/BHMA A156.5 and ANSI/BHMA A156.25, Grade 1 components. Provide devices that are tamper alarmed, tamper and vandal resistant, solid state, and do not contain electronics which could compromise the access control subsystem should the subsystem be attacked. Provide surface, semi-flush, pedestal, or weatherproof mountable devices as specified for each individual location. Each device to contain a visual display, either mounted on the face, or on an integral part of the device, to indicate access or exit request processing, request approval, and request denial. Provide swipe through type card readers capable of reading magnetic stripe, high coercivity magnetic stripe, Wiegand, Hollerith, proximity, Transmissive Infrared, or Smart Card type access control cards, as directed by WETA.

Provide keypads that contain an integral 12-digit tactile keyboard with digits arranged in numerical order. Provide keypads that are a standalone device or integrated into the card reader, as directed by WETA.

2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latch bolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

2.8 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Acceptable Manufacturers:
   a. Norton Door Controls (NO) - 7500 Series.
   b. Or Equivalent

2.9 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock

absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:
   a. Rixson Door Controls (RF).
   b. Rockwood Manufacturing (RO).
   c. Sargent Manufacturing (SA).
   d. Or Equivalent

2.10 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.11 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify Owner of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.3 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at the time of WETA's occupancy.

3.6 DEMONSTRATION

A. Instruct WETA's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

END OF SECTION

SECTION 09 97 13

STEEL COATINGS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design/Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design-Builder.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

A. This section provides the minimum requirements for the coating of external and interior ferrous metal surfaces for the Vallejo Ferry Terminal Reconfiguration Project including but not limited to the steel pilings and all steel framing. Steel float work will be divided between the Fabricator and Contractor. See specification section 35 50 00 STEEL FLOAT for additional information including the complete design and construction responsibilities of the Fabricator and Contractor (with respect to the float).

B. Work shall include surface preparation, primer, first and/or final coats.

C. When delivered to WETA's facility, all ferrous metal shall be coated, except no coating is required on stainless steel material or steel coated by hot dip galvanizing.

1.3 REFERENCES

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

A. American Society of Testing and Materials (ASTM)

1. D610 Evaluating Degree of Rusting on Surfaces of Painted Steel.
2. D659 Evaluating Degree of Chalking of Exterior Paint.
3. D660 Evaluating Degree of Checking of Exterior Paint.
4. D661 Evaluating Degree of Cracking of Exterior Paint.
5. D662 Evaluating Degree of Erosion of Exterior Paint.
6. D714 Evaluating Degree of Blistering of Paint.
7. D772 Evaluating Degree of Flaking (Scaling) of Exterior Paint.

B. National Association of Corrosion Engineers (NACE)

1. NACE Standard SP0188-2006-SG (formerly RP0188), Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrate

C. Steel Structures Painting Council (SSPC)

1. SP6 Commercial Blast Cleaning
2. SP10 Near-White Blast Cleaning

1.4 REGULATORY REQUIREMENTS

A. Paint products and applications shall comply with the regulations of the:

1. California Environmental Protection Agency, Air Resources Board, Coating Rules in California
2. Bay Area Air Quality Management District
3. 2016 California Green Building Standards Code (Cal. Code Regs., Title 24, Part 11) (Nonresidential, Mandatory) per the California Building Officials (CALBO) and the International Code Council (ICC).

1.5 SUBMITTALS

A. Product data for each coating system specified.

1. Provide a listing of each paint and coating to be used on the project. Include the manufacturer's name, product name, specific Volatile Organic Compound (VOC) data (in g/L) for each product, and the corresponding allowable VOC from the referenced standard.

2. Provide the manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material proposed for use.

3. For each material, cross-reference the specific coating, finish system, and area of application. Identify each material by the manufacturer's catalog number and general classification.

4. Provide certification by the manufacturer that products supplied comply with all applicable City of Vallejo, California, and United States regulations limiting VOCs.

B. Coating Manufacturer's "Coating Application, Maintenance and Repair Procedures Manual" for each coating system used.

1. Coating Application: Application shall describe surface preparation requirements, the maximum time allowed between surface preparation and primer application, primer and topcoat(s) curing time, and procedure for checking dry film thickness of the primer and top coats(s). Identify procedures for coating critical mil thickness locations (e.g. fillets, edges, welds, bolted connections).
   a. Weather and Dew Point.
   b. Method of Application (brush, roll, or spray including what type of equipment).
   c. Mil thickness and time between surface preparation and application of primer.
   d. Equipment cleanliness.
   e. Surface preparation prior to application of each coat.
   f. Drying time between primer and finish coat(s) and after application of finish coat.
   g. Pot Life.
   h. Thinning.

i. General application techniques for critical areas to be coated
j. Curing requirements

2. Maintenance: The maintenance procedure shall provide a systematic process for inspection, record keeping and observation, coating application, and repair procedures.

3. Repair: Repair procedures shall establish when a repair is required, what type of repair should be done, with what materials, at what time, and in what manner. Type of failures may include, but are not limited to, undercutting, blistering, pinpoint rusting, delamination, chalking, checking, and abrasion.

C. Samples: Provide the manufacturer's color chart for representative colors available, inclusive of matte, semi-gloss and glossy textures, samples of each color and material to be applied with texture to simulate actual conditions on representative samples of the actual substrate.

1. Paint: After initial colors are selected by WETA, submit three samples on 4 in. x 4 in. steel substrate for WETA's review and final color selection.
2. Non-Skid Coating: Submit three 6 in. x 6 in. samples

1.6 QUALITY ASSURANCE

A. Paint Applicator Qualifications: Paint contractors shall be qualified by audit according to criteria accepted under SSPC guidelines.

B. Discontinuity (Holiday) Testing Firm Qualifications: Submit qualifications of testing firm for approval.

C. Single-Source Responsibility: Provide primers and undercoat material produced by the same manufacturer as the finish coat(s) for each type of coating. The Contractor shall provide documentation that the individual coats (i.e., primer, intermediate and top coat) are compatible. Use only thinners recommended by the manufacturer and only within the recommended limits.

D. Final acceptance of job-applied colors will be based on samples.

1.7 GENERAL

A. All structural steel shall have all surface preparation and coatings applied in a shop prior to delivery to the site. Field painting and coating to be minimized and limited to touch up work and coatings applied after field welding.

B. Only a primer coat is to be applied in areas that fall within 6 in. of where field welding of structural steel will occur.

C. Deliver materials to the shop and field in the manufacturer's original, new, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Name or title of material
2. Manufacturer's name, stock number and date of manufacture
3. Contents by volume, for major pigment and vehicle constituents
4. Thinning instructions
5. Application instructions

6. Color name and number
7. Handling instructions and precautions
8. VOC content in g/L

D. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 degrees F (or greater if required by the manufacturer) in a well-ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.

E. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary precautionary measures to ensure that workers and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and applying coatings.

1.8 COATING COLOR SCHEDULE

Color schedule to be approved by WETA:

A. Pilings	Light to medium gray
B. Items Not Listed	Contact WETA

1.9 WARRANTY

A. The Fabricator and/or Contractor shall warrant all coating systems for a period of not less than five (5) years.

PART 2 - PRODUCTS

2.1 PREPARATION AND COATING THICKNESS

A. The preparation and coating of surfaces shall be as required herein.

B. Before the application of any coat, all defects on the preceding coat shall be repaired.

C. Where coating is damaged and repairs are made, the affected areas are to be touched up with coating per manufacturer’s directions to match the surrounding area.

D. All exposed steel surfaces including sides and edges, shall be painted.

2.2 MATERIALS

A. VOC limits

1. Do not apply any zinc primer with VOC content exceeding 340 g/L.

2. For piles: Do not apply any anticorrosive epoxy primer with VOC content exceeding 400 g/L. Do not apply any second or third coat with VOC content exceeding 300 g/L.

3. Do not apply any coating material with VOC content exceeding 400 g/L.

B. “Devoe Coatings” products are listed; equivalent products may be substituted if preapproved.

C. Steel Piling

1. Surface Preparation: SSPC-SP10 anchor pattern blast profile @ 2 to 3 mils.

2. Prime and Second Coat:
Bar-Rust 235 Multi-Purpose Epoxy Coating as manufactured by Devoe Coatings with the thickness of each coat per manufacturer recommendations and the total thickness of the two coats at least 15 mils DFT.

D. All Other Steel Surfaces not identified as galvanized or stainless steel

1. Surface Preparation: SSPC-SP6 or higher with a 1.0 to 3.0 mil surface profile

2. Prime and Second Coat:
Bar-Rust 235 Multi-Purpose Epoxy Coating as manufactured by Devoe Coatings with the thickness of each coat per manufacturer recommendations and the total thickness of the two coats at least 15 mils DFT.

3. UV Coat: Interthane 990HS

PART 3 - EXECUTION

3.1 COATING

A. The Coating Manufacturer shall prepare specifically for this project a Coating Application, Maintenance and Repair Procedures Manual. This manual shall specify specific application, maintenance and repair requirements for this Project.

B. Surface Preparation: Clean surfaces to the surface specifications noted in accordance with the Steel Structures Painting Council specifications.

C. Application:

1. Apply coatings in accordance with coating manufacturer requirements.

2. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are between 50 degrees Fahrenheit and 90 degrees Fahrenheit. Maintain this temperature range 24 hours before and 72 hours after installation of coating.

3. Do not apply coatings in snow, rain, fog, or mist; when the relative humidity exceeds 85 percent (or unless otherwise specified by coating manufacturer); at temperatures less than 5 degrees Fahrenheit above the dew point; or to damp or wet surfaces. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.

4. All applicators shall understand and follow the Coating Application, Maintenance and Repair Procedure Manual Requirements.

3.2 INSPECTION

1. Each coating shall be inspected for discontinuities (holidays and pinholes) in accordance with NACE Standard SP0188-2006-SG (formerly RP0188), Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates. This standard provides a procedure for electrical detection of minute discontinuities in coating systems that are liquid-applied to conductive substrates other than pipelines. All discontinuities shall be repaired at the Contractors expense.

3.3 MAINTENANCE

A. Responsibility: The coating manufacturer shall be responsible for establishing surface preparation, coating application, maintenance and repair procedures based on the requirements specified herein and by the manufacturer's product requirements.

B. Coating Evaluation: Where evaluation of the coating prior to or during the warranty period indicates coating deterioration or failure, the extent of failure shall be determined by visual inspection and the use of one the following ASTM standards, as required by the type of failure involved:

1. ASTM D610 - Evaluating Degree of Rusting on Surfaces of Painted Steel.
2. ASTM D659 - Evaluating Degree of Chalking of Exterior Paint.
3. ASTM D660 - Evaluating Degree of Checking of Exterior Paint.
4. ASTM D661 - Evaluating Degree of Cracking of Exterior Paint.
5. ASTM D662 - Evaluating Degree of Erosion of Exterior Paint.
6. ASTM D714 - Evaluating Degree of Blistering of Paint.
7. ASTM D772 - Evaluating Degree of Flaking (Scaling) of Exterior Paint.

3.4 REPAIR

A. The Contractor shall be responsible for coating repair from the date of Notice to Proceed through the warranty period.

B. Repair procedures shall be as specified by the coating manufacturer. Repair procedures will vary because of the variety of coating failure types.

C. At substantial completion, repairs to damaged or defaced coated surfaces shall be complete.

D. Field welding and splicing of steel pipe piles shall require repair and re-application of shop coatings per manufacturer's recommendations.

3.5 CLEANING

A. Clean-Up: At the end of each workday, remove rubbish, empty cans, rags and other discarded materials from the site.

B. Upon completion of work, clean spattered surfaces. Remove spattered coatings by washing, scraping or other proper methods, using care not to scratch or damage adjacent finished surfaces.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHERS, SAFETY EQUIPMENT & CABINETS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cabinet mounted portable fire extinguishers and ring buoys with accessories as required for complete installation.

1.2 SUBMITTALS

A. Product Data: Furnish manufacturer's literature.

PART 2 - PRODUCTS

2.1 SYSTEMS MANUFACTURERS

A. J.L. Industries.

B. Larsen’s Manufacturing Co.

C. Potter Roemer.

D. Cheyenne Manufacturing company.

2.2 MATERIALS

A. System Description:

1. Replace portable fire extinguishers in weatherproof cabinets
2. Replace ring buoys in weatherproof cabinets

B. Fire Extinguishers: Provide 4A-60BC multi-purpose dry chemical type fire extinguisher at locations indicated on Drawings and/or as required by Fire Marshal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fire extinguishers in locations and at mounting height to comply with requirements of governing authorities.

B. Securely fasten brackets to structure, square and plumb, in accordance with manufacturer's instructions.

1. Wherever exact location of units is not shown, locate as directed by Architect.

3.2 IDENTIFICATION

A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.

B. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 21 11 00

FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

A. Section includes fire-suppression water-service piping and related components outdoors, and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.

B. Related Requirements:

1. Section 21 11 19 "FIRE-DEPARTMENT CONNECTIONS" for exposed-, flush-, and yard- type, fire-department connections.
2. Section 21 12 00 "FIRE-SUPRESSION STANDPIPES" for fire-suppression standpipes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
3. Comply with City of Vallejo Fire Department requirements, including any evacuation provisions required.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect fittings and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by WETA or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify WETA's Representative and WETA no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without WETA's Representative or WETA's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.2 STAINLESS STEEL PIPE AND FITTINGS

A. 316 Stainless Steel, Fire-Service Pipe: FM Global approved, ASTM A312; ASTM A795, Type E; or ASME B36.19M, with minimum thickness Schedule 40 and equivalent to Class 150.

B. 316 Stainless steel Fittings: FM Global approved; made to match stainless steel pipe dimensions and class.

C. Stainless Steel Couplings: ASTM A 865, threaded.

D. Stainless Steel threaded Fittings: ASTM A815.

2.3 PE PIPE AND FITTINGS

A. PE, Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to Class 150.

B. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

2.4 SPECIAL PIPE FITTINGS

A. Stainless Steel Flexible Expansion Joints:

1. Description: Provide flexible expansion joints on fire suppression piping where indicated. Refer to Section 22 05 16 “Expansion Fittings for Piping”.

2.5 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: PE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness].

C. Form: Sheet.

2.6 JOINING MATERIALS

A. Gaskets for Ferrous Piping: ASME B16.21, asbestos free.

2.7 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 31 20 00 "Earthwork."

3.2 PIPING INSTALLATION

A. Comply with NFPA 24 for fire-service-main piping materials and installation.

B. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install encasement for piping according to ASTM A 674 or AWWA C105.

C. Install PE pipe according to ASTM D 2774 and ASTM F 645.

D. Bury piping with depth of cover over top at least 30 inches, and according to the following:

1. In Loose Gravelly Soil and Rock: With at least 12 inches of additional cover.

E. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

F. Extend fire-suppression water-service piping and connect to locations indicated.

G. Comply with requirements for fire-suppression water-service piping in the following Sections:

1. Section 21 12 00 "Fire-Suppression Standpipes"

3.3 JOINT CONSTRUCTION

A. Install couplings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

C. Ream ends of tubes and remove burrs.

D. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

E. Stainless Steel Piping, Gasketed Joints for Fire-Service-Main Piping: UL 213.

F. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

G. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

H. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Heat-fused joints
3. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

A. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24.

B. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

C. MSS Valves: Install as component of connected piping system.

D. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 03 30 00 "Cast-in-Place Concrete."

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards on two sides of shore freestanding fire-department connection.

3.7 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.8 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping.

B. Permanently attach plastic marker indicating fire-suppression water-service piping.

3.9 CLEANING

A. Clean fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

B. Prepare reports of purging activities.

3.10 PIPING SCHEDULE

A. Underground fire-suppression water-service piping NPS 3 shall be one of the following:

1. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
2. PE, Class 150, fire-service pipe; molded PE fittings; and heat-fusion joints.

B. Aboveground fire-suppression water-service piping shall be 316 stainless-steel pipe and nipples; 316 stainless steel threaded fittings; and threaded joints.

END OF SECTION

SECTION 21 11 19

FIRE DEPARTMENT CONNECTIONS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

A. Section Includes:

1. Exposed-type fire-department connections.
2. Yard-type fire-department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405.

B. Type: Exposed, projecting, for wall mounting.

C. Pressure Rating: 175 psig minimum.

D. Body Material: Corrosion-resistant metal.

E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

F. Caps: Brass, lugged type, with gasket and chain.

G. Escutcheon Plate: Round, brass, wall type.

H. Outlet: Back, with pipe threads.

2.2 YARD-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405.

B. Type: Exposed, freestanding.

C. Pressure Rating: 175 psig.

D. Body Material: Corrosion-resistant metal.

E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

F. Caps: Brass, lugged type, with gasket and chain.

G. Escutcheon Plate: Round, brass, floor type.

H. Outlet: Bottom, with pipe threads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

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

3.2 INSTALLATION

A. Install yard-type fire-department connections in approach concrete slab support.

B. Install two protective pipe bollards on sides of each fire-department connection.

C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION

SECTION 21 12 00

FIRE-SUPPRESSION STANDPIPES

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTIONS

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection specialty valves.
3. Hose connections.

B. Related Requirements:

1. Section 21 11 19 "FIRE DEPARTMENT CONNECTIONS" for exposed and yard-type fire- department connections.
2. Section 21 11 00 "FACILITY FIRE SUPRESSION WATER-SERVICE PIPING" for water-service piping.

1.3 DEFINITIONS

A. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at maximum working pressure of 175 psig.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-suppression standpipes.

1. Include plans, elevations, sections, and attachment details.

C. Delegated-Design Submittal: For standpipe systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, sections, and other details, drawn to scale, or BIM model, showing the items described in this Section and coordinated with all building trades.

B. Qualification Data: For Installer and professional engineer.

C. Approved Standpipe Drawings: Working plans, prepared in accordance with NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services needed to assume engineering responsibility.
   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Manual Dry-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections but does not have permanent water supply. Piping is dry. Water must be pumped into standpipes to satisfy demand.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14.

C. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig minimum working pressure.

D. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.3 PIPING MATERIALS

A. Comply with requirements in Part 3 "Piping Schedule" Article for applications of pipe, tube, and fitting materials and for joining methods for specific services, service locations, and pipe sizes.

2.4 STAINLESS STEEL PIPE AND ASSOCIATED FITTINGS

A. Refer to Section 21 11 00 "Facility Fire-Suppression Water-Service Piping".

2.5 BLACK STEEL PIPE AND ASSOCIATED FITTINGS

A. Schedule 40: ASTM A53/A53M, Type E, Grade B, with factory- or field-formed ends to accommodate joining method.

B. Schedule 30: ASTM A53/A53M, Type E, Grade B with factory- or field-formed ends to accommodate joining method.

C. Uncoated, Steel Couplings: ASTM A865/A865M, threaded.

1. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating:
   a. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
3. Body Material: Corrosion resistant.
4. Size: Same as connected piping.
5. End Connections: Grooved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for stations to verify actual locations of piping connections before installation.

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

3.2 PIPING

A. Install shutoff valve, check valve, and drain.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with WETA before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.

C. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install drain valves on standpipes.

E. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves.

F. Install hangers and supports for standpipe system piping in accordance with NFPA 14. Comply with requirements in NFPA 13 for hanger materials.

G. Drain standpipe system piping.

H. Pressurize and check standpipe system piping.

3.4 JOINT CONSTRUCTION

A. Install couplings, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

E. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

F. Stainless Steel or Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe joints.

G. Stainless Steel or Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe in accordance with AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings in accordance with AWWA C606 for steel-pipe grooved joints.

H. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, and specialties in accordance with NFPA 14, authorities having jurisdiction and manufacturer's instructions.

B. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

3.6 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping in accordance with NFPA 14 requirements.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust safeties. Replace damaged and malfunctioning equipment.
3. Flush, test, and inspect standpipe systems in accordance with NFPA 14, "System Acceptance" chapter.
4. Verify that equipment hose threads are same as local fire-department equipment.

C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Standard-weight stainless- steel or epoxy coated black-steel pipe with threaded ends, cast-iron threaded fittings, and threaded or grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Standard-pressure, fire-suppression standpipe piping, NPS 4 and smaller, shall be one of the following:

1. Schedule 40 or Schedule 30, stainless-steel or epoxy coated black-steel pipe with threaded ends; gray-iron threaded fittings; and threaded joints.
2. Schedule 40 or Schedule 30, stainless-steel or epoxy coated black-steel pipe with cut- or roll-grooved ends; grooved-end fittings for piping; grooved-end-pipe couplings for piping; and grooved joints.
3. Stainless steel pipe shall be used for the float fire department connection standpipe.

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS FOR PIPING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

A. Section Includes:

1. Flexible-hose expansion joints.
2. Expansion joint anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate requirements for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of expansion joint, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code – Stainless Steel."
3. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Flexible-Hose Expansion Joints:

1. Description: Manufactured assembly with flexible-metal-hose in long-radius, 180-degree return bend.
2. Domestic Water Flexible Hose: UV and ozone resistant, synthetic fiber reinforced, SBR rubber tubing with NBR covering and ends fused to inner tubing.
3. Expansion loops for Stainless Steel Piping NPS 2 and Smaller: Stainless-steel fittings with threaded end connections.
   a. Hoses and sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.
4. Expansion loops for Stainless Steel Piping NPS 2-1/2 to NPS 6: Stainless-steel fittings with flanged end connections.
   a. Hoses and sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

3.2 ANCHOR INSTALLATION

A. Attach expansion fittings to pipe and secure pipe by attachments to pier structure.

B. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected pipe.

C. Anchor Attachments:

1. Anchor Attachment to stainless-Steel and ductile iron Pipe: Attach with pipe hangers and supports.

D. Fabricate and install stainless steel anchors. Comply with ASME B31.9.

1. Anchor Attachment to Steel Structural Members: Attach by bolting.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

E. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures

1.2 DESCRIPTION

A. Section Includes:

1. Underground and aboveground domestic water pipes, tubes, and fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by WETA or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify WETA's Representative no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without WETA's Representative written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping, and components shall comply with NSF 14 and NSF 61.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 STAINLESS-STEEL PIPING

A. Potable-water piping and components shall comply with NSF 61.

B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 40.

C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install shutoff valve, at each domestic water-service connection.

C. Install domestic water piping level without pitch and plumb.

D. Install seismic restraints on piping.

E. Install piping indicated to be exposed at right angles or parallel to deck and walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping to permit valve servicing.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.5 HANGER AND SUPPORT INSTALLATION

A. Provide seismic-restraint devices for aboveground piping for piping hanging 12 inches or more below supporting structure.

B. Comply with the following requirements:

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

A. Support vertical piping and tubing at base.

B. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

C. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.

D. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches with 3/8-inch rod.

E. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings shall indicate general arrangement of piping, fittings, and specialties.

B. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Piping Inspections:
   a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by Authorities having Jurisdiction.
   b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.

d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 ADJUSTING

A. Perform the following adjustments before operation:

1. Close hose bibbs.
2. Open shutoff valves to fully open position.
3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
5. Remove filter cartridges from housings and verify that cartridges are as specified for application were used and are clean and ready for use.
6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:
   1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
   2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for 3 hours.
c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Underground domestic water piping, NPS 3 and smaller, shall be the following:

1. Copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. 316 stainless-steel pipe and nipples; 316 stainless steel threaded fittings; and threaded joints.

3.11 VALVE SCHEDULE

A. The following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Hose bibbs.
4. Water-hammer arresters.
5. Flexible hose.
6. Water meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

2.4 BACKFLOW PREVENTERS

A. Conform to City of Vallejo or utility company standards.

B. Double-Check, Backflow-Prevention Assemblies:

1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 and smaller.
5. End Connections: Threaded for NPS 2 and smaller.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:
    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller.
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
    a. Strainers NPS 2 and Smaller: 0.033 inch.
6. Drain: Pipe plug.

2.6 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.

4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish: Rough bronze.
9. Operation for piers: Removable key.
10. Operation for Deck hoses: Wheel handle.

2.7 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Stainless Steel bellows.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.8 FLEXIBLE HOSE

A. Hose Flexible Connectors: For potable water, UV and ozone resistant, synthetic fiber reinforced, SBR rubber tubing with NBR covering and ends fused to inner tubing. 12-inch minimum bend radius, 180-degree return bend. Tube materials shall be suitable for short term contact with chlorine sterilization solution. Seal coupling with anaerobic resin compound, 20 mil dry film thickness.

1. Working-Pressure Rating: Minimum 150 psig.

2.9 WATER METERS

A. Conform to City of Vallejo or utility company standards.

B. Displacement-Type Water Meters:

1. Description:
   a. Standard: AWWA C700.
   b. Pressure Rating: 150-psig working pressure.
   c. Body Design: Nutating disc; totalization meter.
   d. Registration: In gallons or cubic feet as required by the City of Vallejo or utility company.
   e. Case: Bronze.
   f. End Connections: Threaded.

C. Turbine-Type Water Meters

1. Description:
   a. Standard: AWWA C701.
   b. Pressure Rating: 150-psig working pressure.
   c. Body Design: Turbine; totalization meter.
   d. Registration: In gallons or cubic feet as required by the City of Vallejo or utility company.
   e. Case: Bronze.
   f. End Connections for Meters NPS 2 and Smaller: Threaded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in water supply to equipment and systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Do not install bypass piping around backflow preventers.

B. Install water-hammer arresters in water piping according to PDI-WH 201, concealed under float deck platform.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker, and double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 WORK NOT INCLUDED

A. Cooperate with the other trades who may or may not be party to this Contract for the purpose of coordinating the electrical requirements and installation of equipment, materials, and furnishings provided by those other trades, including the Owner.

1.2 CODES AND STANDARDS

A. Provide equipment and materials which conform to, and perform the installation thereof in accordance with the following codes and industry standards:

1. California Electrical Code (CEC).
2. National Electrical Code (NEC).
3. California Building Code (CBC).
4. California Fire Code (CFC).
5. Titles 8, 19 and 24 of the California Code of Regulations (CCR).
6. American National Standards Institute (ANSI).
7. California State Fire Marshal (CSFM).
8. Underwriters' Laboratories (UL).
9. National Electrical Manufacturers' Association (NEMA).
10. Institute of Electrical and Electronics Engineers (IEEE).
11. National Electrical Safety Code (NESC).
    a. Electrical Safety Orders.
12. Other applicable local codes and ordinances.

B. Where the authority-having-jurisdiction makes an interpretation or decision, as is their prerogative in accordance with the Code, such direction shall be considered a part of these Contract Documents as if contained herein. With respect to completing the intent of the Contract Documents, comply with any and all requirements of the authority-having- jurisdiction and utility company field inspectors, at no additional cost.

C. The above referenced codes and standards are considered to be absolute minimum requirements. The Drawings and Specifications shall take precedence over the above referenced codes and standards where materials or workmanship of higher quality or larger size is indicated. Nothing in these Drawings or Specifications shall be construed to allow work not conforming to the applicable codes and standards.

1.3 UTILITY FEES

A. Pay utility company charges for normal or after hours shutdowns, service calls, repairs, and cable locating that are directly related to the installation of the Electrical Work.

1.4 WORKING SPACE

A. Maintain adequate work space around, and access to, electrical and mechanical equipment in strict accordance with the applicable Codes. Verify during the course of construction that sufficient space will be available for the installation and maintenance of equipment, fixtures, etc.

1.5 MATERIALS AND SUBSTITUTIONS

A. Specific trade names are used in the Drawings and Specifications in order to establish the standard grade and characteristics of said items. This does not imply the right upon the part of the Contractor to use other materials or methods without the approval of the Owner.

B. Electrical materials and equipment shall bear the label of, or be listed by, the Underwriters' Laboratories (UL) wherever standards have been established and label service is regularly furnished by that agency. Comply with the installation and application requirements of UL as documented in their published directories.

C. Maintain uniformity throughout the Project by making use of only one make or brand of material for each material used.

1.6 ELECTRICAL SUBMITTALS

A. Shop Drawings for equipment and materials as noted in each Division 26 specification section. Bind the submittals as complete volumes according to classification of equipment such as power, lighting, fire alarm, etc. When possible, make all electrical submittals at the same time.

B. Arrange panelboard submittals to show bussing, circuit numbering, and branch circuit protective devices similar the schedules as indicated. Show elevations of switchboards, motor control centers, and distribution centers indicating the layout of devices, meters, handles, etc. Provide device ratings, circuit numbers, and nameplate descriptions in table form. Include terminal strip mounting arrangements on elevations for terminal cabinets.

C. Submit test reports as noted in each Division 26 specification section.

1.7 DRAWINGS AND SPECIFICATIONS

A. The data and information contained on the Drawings is as accurate as was reasonably possible at the time they were produced, but absolute accuracy is not guaranteed. Exact locations, distances, elevations, etc., will be dictated by the actual building and the conditions at the site.

B. The layout of electrical equipment, wiring, and accessories is shown in a diagrammatic fashion (not pictorially) in order to achieve clarity and legibility. Although the size and location of electrical equipment is drawn to scale wherever possible, refer to all data in the Contract Documents and field verify this information as the project progresses. Examine architectural, structural, mechanical, and other drawings to determine the exact location of conduits, outlets, fixtures, and equipment and to note any conditions which may affect the electrical work.

C. Because the Electrical Drawings may be distorted for clarity of representation, it may be necessary to field verify the exact location of electrical outlets, lights, controls, ramp levelers, etc. in order to conform to the terminal elements. The Owner reserves the right to make minor changes to the locations of equipment, devices, and wiring shown, at no additional cost, providing the changes are ordered before the rough-in of conduit, boxes, or related items is completed, and no extra material are required.

D. Conduit quantities, sizes, termination points, and wiring are indicated. However, not all conduit bends or routing details are indicated. Route conduit so as to conform to the structural conditions, avoid obstructing other trades, maintain space restrictions and keep circulation areas and access openings clear.

1.8 WORKMANSHIP

A. Constantly supervise the work personally or through an authorized and competent representative. Keep the same foreman or supervisor on the project from commencement through completion.

1.9 MANUFACTURER'S DIRECTIONS

A. Adhere to the manufacturer's directions regarding the proper installation and configuration of electrical equipment where those directions cover points not included in these Drawings and Specifications.

1.10 PROTECTION AND STORAGE

A. Deliver electrical materials to the site new, and in unbroken packages. Protect electrical equipment and materials during transit, storage and handling to prevent damage, soiling and deterioration.

B. During shipping storage and handling protect electrical materials from damage of any type including dust, water, over-spray, and temperature. Avoid damage during construction to the work and materials of other trades as well as the electrical work and material. Repair or replace, at the Contractor's expense, defective or damaged items such that the entire Work is completed in a condition satisfactory to the Owner.

1.11 EXCAVATION, CUTTING, PATCHING, AND REPAIR

A. Perform excavation and backfill required for the installation of electrical sub-structures. Restore grounds, walkways, roadways, curbs, walls, and other existing underground facilities to their original condition.

B. Cut, core-drill, and demolish existing walls, floors, ceilings and other building surfaces as required for the installation of Electrical Work. Obtain the approval of the Owner prior to performing any operation which may affect any structural elements of the building.

C. Patch and repair wood, plaster, tile, or concrete surfaces which have been damaged by the installation of the Electrical Work so that the finished surface matches the surrounding conditions.

1.12 FLASHING, WATERPROOFING AND SEALING

A. In general, install in an approved watertight manner, Electrical Work which pierces exterior walls or waterproofing membranes. Flash and counter-flash roof and wall penetrations in a manner described in other applicable sections of this Specification and as approved by the Owner.

B. Fit conduits passing through finished walls with steel escutcheon plates of brass, chrome, or painted finish as directed by the Owner. Grout penetrations of floor slabs, concrete or masonry walls with an approved grout or silicone elastomeric caulk.

1.13 CLEANING, ADJUSTING, AND TOUCH-UP

A. Remove on a daily basis electrical debris, scraps, packaging material and other rubbish. Dispose of such items off-site in an approved manner and debris. Maintain the site free from physical hazards at all times in accordance with OSHA regulations.

B. After installation, completely clean electrical equipment, fixtures, and materials of excess paint, over-spray, plaster, cement, insulating products, and other foreign matter. Leave the Electrical Work in a clean, finished, dry, level, like new condition.

C. Touch-up paint scratches and scuffs on electrical equipment and lighting fixtures with paint recommended by the manufacturer and matching the original item finish.

D. Make setting, adjustments, and programming in accordance with the manufactures' operating and installation instructions. Settings and program variables will be issued by the Owner prior to commissioning of the electrical system.

1.14 AS-BUILT DRAWINGS

A. Throughout the project, maintain accurate and current record documents. Show on the record drawings deviations from the Electrical Drawings, locations of underground conduits and pull-boxes, and concealed equipment which is not readily apparent. Dimension the record drawings using permanent, readily identified benchmarks such as column or wall lines.

1.15 INSPECTIONS AND TESTING

A. Arrange for the inspection of the Work at various stages of completion by the Authority Having Jurisdiction, utility company representatives, and the Owner. Comply with all directions and remedial measures issued thereby. Any objections to these orders on the part of the Contractor must be presented to the Owner in writing within 48 hours of the inspection report.

B. Coordinate the installation of the Work so that observation of all rough-in, concealed, or underground Work can take place by the Owner. Provide a minimum of 72 hours' notice to the Owner prior to covering up the work. Uncover Work that has not been properly observed and make repairs to restore the Work and adjoining surfaces to their proper condition at no additional cost.

C. Perform tests of the electrical system during the course of the project and at project completion to ensure safe and proper function in accordance with the Contract Documents, manufacturers' recommendations, and applicable codes. Testing shall include, but not necessarily be limited to, the following:

1. Test for short circuits, open circuits, neutral leakage, and improper grounds on feeders and branch circuits. Perform this test with mains in disconnect from feeders, branch circuits closed, fixtures and devices permanently connected, lamps removed from sockets and wall switches closed.
2. Provide insulation resistance tests of all phase and neutral circuit conductors using a 500 Volt Megger for circuits of 240 Volt rating and below, and a 1000 Volt Megger for circuits of 277 volts and above. Minimum acceptable insulation resistance is one (1) megohm.
3. Perform a ground resistance test of each main grounding electrode system, ground rod, and supplemental grounding electrode. Utilize a calibrated, direct reading, earth ground test set and make the tests using the “Three-terminal, Fall-of-Potential” method. The maximum allowable earth ground resistance is 25 ohms.
4. Test for proper phase-to-phase and phase-to-neutral operating voltage on the main service and on each separately derived system. Perform this test at full load and at no load. With all circuits at full operating conditions, test the phase and neutral load currents using a clamp-on ammeter.
5. Tests as required by other sections of these Specifications.
6. Tests as prescribed by individual equipment manufacturers whether or not described in these Specifications.

D. Demonstrate to the Owner that the entire installation is complete, in proper operation condition. Activate all circuits, lights, devices, and controls under full load and normal operating conditions. Identify faulty items and immediately replace or repair defective equipment, workmanship, and materials to like new condition and retest in the presence of the Owner.

E. Demonstrate to the Owner that the entire electrical system is free from short circuits and improper grounds, or upon request of the Owner anytime, make necessary tests under the observation of the Owner which will ensure that electrical equipment, materials and installation methods are as specified.

1.16 WARRANTIES, CERTIFICATES, AND OPERATING MANUALS

A. Properly fill out and deliver to the Owner, all warranties, guarantees, certificates, etc. for equipment and materials. The effective date on each item shall be the date of acceptance of the work by the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Available Manufacturers:

1. Alcan Aluminum Corporation; Alcan Cable Div.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

D. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated. All splices on the dock shall be submersible type.

B. Available Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Feeders Concealed in raceway and utility chase: Type THHN/THWN-2, single conductors in raceway.

C. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Branch Circuits Concealed in flexible conduit: Type THHN/THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished deck, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

F. Support cables according to Section 26 05 29 "Electrical Hangers and Supports."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque- tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with marina application and submersible type.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Electrical Identification."

B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:
   a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
   b. Test bolted connections for high resistance using one of the following:
      1) A low-resistance ohmmeter.
      2) Calibrated torque wrench.
      3) Thermographic survey.
   c. Inspect compression-applied connectors for correct cable match and indentation.
   d. Inspect for correct identification.
   e. Inspect cable jacket and condition.
   f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
   g. Continuity test on each conductor and cable.
   h. Uniform resistance of parallel conductors.

D. Cables will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 29

ELECTRICAL HANGERS AND SUPPORTS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Conduit and cable support devices.
2. Support for conductors in vertical conduit.
3. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.

B. Related Requirements:

1. Products and installation requirements necessary for compliance with seismic and marina environment criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
   a. Slotted support systems, hardware, and accessories.
   b. Clamps.
   c. Hangers.
   d. Sockets.
   e. Eye nuts.
   f. Fasteners.
   g. Anchors.
   h. Saddles.
   i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.

3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

1. Manufacturers:
   a. Alli3d Tubing
   b. Cooper Industries
   c. Unistrut
   d. Or Approved Equal

Standard: Comply with stainless steel components for field assembly.

B. Conduit and Cable Support Devices: Stainless steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of stainless steel.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Stainless steel fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used. Allowed Manufacturers are:
   a. Hilti, Inc
   b. OZ Gedney
   c. Or Approved Equal

2. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened Portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used. Allowed Manufacturers are:
   a. Cooper B-Line
   b. Hilti, Inc
   c. Or Approved Equal

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A325.

6. Toggle Bolts: All-stainless steel springhead type.

7. Hanger Rods: Threaded stainless steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 101

B. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with stainless steel slotted support system, sized so capacity can be increased by at least 30 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag stainless steel screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

B. Available Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

C. Rigid Steel Conduit: ANSI C80.1.

D. Aluminum Rigid Conduit: ANSI C80.5.

E. IMC: ANSI C80.6.

F. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. ARC: Comply with ANSI C80.5 and UL 6A.
4. IMC: Comply with ANSI C80.6 and UL 1242.
   a. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit. Comply with NEMA RN 1.
   b. Coating Thickness: 0.040 inch (1 mm), minimum.
5. EMT: Comply with ANSI C80.3 and UL 797.
6. FMC: Comply with UL 1; zinc-coated steel.
7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
3. Fittings for EMT:
   a. Material: Steel.
   b. Type: Setscrew.
4. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
5. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Schedule 40: Conduit shall be 90 degree Celsius, polyvinyl chloride in conformance with NEMA TC-2 and UL 651 requirements.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: IMC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMTRNC.
2. Concealed in Ceilings and Interior Walls and Partitions: EMT ENT or RNC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: GRC.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size:3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only were indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot- water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches (300 mm)of enclosures to which attached.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch (25 mm) 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to IMC before rising above floor.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run

length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters.
2. Legend: Indicate voltage and system.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

2.3 LABELS

A. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and are 12 inches (300 mm) wide. Stop stripes at legends.

D. Underground-Line Warning Tape:

1. Tape:

a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
b. Printing on tape shall be permanent and shall not be damaged by burial operations.
c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. Color and Printing:

a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.

2.6 CABLE TIES

A. General-Purpose Cable Ties: Self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify the identity of each item before installing identification products.

B. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

E. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

F. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

G. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

H. Underground Line Warning Tape:

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

I. Write-on Tags:

1. Place in a location with high visibility and accessibility.

J. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

K. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch- (75-mm-) high, black letters on 20-inch (500-mm) centers.

C. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive labels.

D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl tape applied in bands.

E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "POWER."

F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding bands to identify the phase.

G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

H. Workspace Indication: Apply tape and stencil to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

    a. Power-transfer switches.
    b. Controls with external control power connections.

K. Arc Flash Warning Labeling: Self-adhesive labels.

L. Equipment Identification Labels:

1. Equipment to be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a laminated acrylic or melamine label.
    b. Enclosed switches.
    c. Enclosed circuit breakers.
    d. Contactors.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior lighting fixtures, lamps, ballasts, hangars, trim and diffusers.

B. Exterior lighting fixtures, lamps, ballasts, and poles.

C. Supports, suspension systems, and blocking.

1.2 REFERENCES

A. ANSI C78.379 - Electric Lamps - Classification of the Beam Patterns of Reflector Lamps.

B. ANSI C82.1 - Line Frequency Fluorescent Lamp Ballast.

C. ANSI C82.5 - Reference Ballasts - High-Intensity Discharge and Low Pressure Sodium Lamps

D. ANSI/NFPA 101 - Life Safety Code.

E. International Electrotechnical Commission (IEC)

1. IEC 801-2 Electrostatic Discharge Testing Standard.
2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

F. Illuminating Engineering Society of North America (IESNA)

1. LM-79 – Electrical and Photometric Measurements of Solid State Lighting Products.
2. LM-80 – Measuring Lumen Maintenance of LED Light Sources.

G. National Electrical Manufacturer’s Association (NEMA) SSL-1 – Electronic Drivers for LED Devices, Arrays, or Systems.

H. Underwriters Laboratories, Inc. (UL) 8750 – Light Emitting Diode (LED) Light Sources for Use in Lighting Products

1.3 SUBMITTALS

A. Product Data

1. Light fixtures.

2. Lamps.
3. Ballasts.

1.4 EXTRA MATERIALS

A. LED Fixtures

1. Provide 5 percent or two, whichever is greater, of each complete interior LED fixture type for Owner stock for future replacement. Provide only one extra fixture where fixture is listed for use in a hazardous classified environment.
2. Provide one of each complete exterior LED wall or pole mount fixture for Owner stock for future replacement.

B. Other Fixtures

1. Provide 10 percent or four, whichever is greater, of each type of tempered glass lens.
2. Provide 5 percent or two, whichever is greater of each plastic and other security lens type.
3. Provide 10 percent or one case, whichever is greater, replacement lamp for each lamp installed.
4. Provide 5 percent or two, whichever is greater, of each ballast type.

1.5 WARRANTEE

A. Fixtures and ballasts shall have a minimum 5-year warrantee.

PART 2 - PRODUCTS

2.1 LIGHT FIXTURES – GENERAL

A. Provide lighting fixtures, lamps, ballasts and accessories complete and ready for operation. Furnish the fixtures as indicated on the Drawings and as listed in the fixture schedule. Verify in all cases, the lengths and quantity of fixtures necessary to achieve the indicated results.

B. All lighting fixtures shall have published photometric tests conducted by Electrical Testing Laboratories. Make available the test results upon request. Testing shall include candlepower distribution curves, total fixture efficiency, brightness and shielding angles in longitudinal and transverse directions.

C. Provide lighting fixtures in the finishes and colors as noted on the Drawings.

D. Provide the UL and IBEW labels on all lighting fixtures.

E. Observe the requirements of the CBC Section 2606 regarding plastic lighting diffusers. Fixtures and auxiliary equipment mounted against combustible material shall be approved for such installation.

F. Make-up fixtures with Type AF or equal fixture wire. Provide an identified, approved landing lug for equipment ground wires.

2.2 LED LIGHT FIXTURES

A. General

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be a factory assembled luminaire including all required driver and light engine modules integral to and within a single housing. Lead lengths between driver and light engine shall not exceed 3 feet. Remote luminaire/driver installations are not acceptable.
3. LED light fixtures shall be Reduction of Hazardous Substances (RoHS) compliant.

B. LED Driver Modules

1. Description: Universal voltage switching-mode LED driver module with a rated lifetime of not less than 50,000 hours when operated at an ambient temperature of less than 60-degrees C.
2. LED drivers shall include native 0-10V dimming capabilities without additional control devices or field-installed circuitry. Integral short-circuit, open-circuit and overload fault protection to prevent driver failure.
3. LED drivers shall be capable of producing adequate output current to produce the specified light levels. Compatibility of driver and LED light engine must be tested and ensured by driver manufacturer.
4. Minimum efficiency: 85% at full load.
5. Minimum Operating Ambient Temperature: -20° C (-4° F).
6. Input Voltage: 120V to 277V (±10%) AC at 60Hz. Drivers that require DC input shall include an integral converter that accepts standard line voltage AC.
7. Power Factor: ≥ 0.95.
8. Total Harmonic Distortion: ≤ 20% and meet ANSI C82.11 maximum allowable THD requirements
9. Designed and tested to withstand electrostatic discharges up to 15,000 volts without impairment per IEC 801-2.
10. Electrolytic capacitors to operate at least 20 degrees C below the capacitor's maximum temperature rating when the driver is under fully-loaded conditions and case temperature is 62 degrees C.
11. Maximum inrush current of 2 amperes for 120-volt and 277-volt drivers.
12. Withstand up to a 4,000-volt surge without impairment of performance as defined by ANSI C62.41 Category A.
13. Inaudible in a 27 dBA ambient.

C. LED Light Engine Modules

1. Minimum CRI: 80.
2. Color Temperature: 3500K, unless otherwise noted.
3. Minimum Rated Life: 50,000 hours as per LM79.

D. Electronic Ballasts

1. Manufacturers
   a. Valmont.
   b. Advance.
   c. Universal.
2. Provide fully electronic or hybrid style ballasts.

3. Power factor shall be greater than .85.
4. Ballast factor shall be greater than .87.
5. Total harmonic distortion (THD) shall not exceed: 20% for a 4-foot fluorescent ballast or 32% for an 8-foot fluorescent ballast.
6. Provide UL listed ballasts that meet applicable California Energy Commission requirements.
7. Ballasts must be of the rapid start type; instant start is not acceptable.
8. Acceptable manufacturer: Magnetek, Motorola, or Approved Equal.

E. LED Navigation (Obstruction) Light

1. Manufacturers
   a. Carmanah Sabik.
   b. Approved equal.
2. Description: IP 68 Hight power lighting emitting diode.
3. Batteries powered with sealed lead acid.
4. Premium grade UV resistant, polycarbonate co-plymer body and lens material.
5. Battery: 1 year manufacturer warranty.
6. Light: 3 year manufacturer warranty.

PART 3 - EXECUTION

3.1 GENERAL

A. Install fixtures in straight, true lines and without visible gaps between fixtures and building surfaces and between fixtures in continuous rows. For linear wall mounted fixtures, ensure that the wall surface is finished flat, straight, and free of imperfections prior to mounting the fixtures. Replace or repair lighting fixture installations that are out of plumb or that have obvious gaps or misalignment.

B. Provide fixtures with the appropriate trim frames, flanges, canopies, and finish accessories to accommodate the ceiling conditions. Prior to ordering fixtures, and throughout the Project, verify the exact ceiling types, finishes, and thicknesses and coordinate the fixture installation therewith.

C. Refer to the Drawings, particularly the architectural elevations and reflected ceiling plans, in determining the exact mounting location and height of lighting fixtures. For wall mounted or suspended fixtures that do not have the mounting heights clearly indicated, contact the Owner for clarification prior to ordering pendants and installing the fixtures.

D. Following installation of HID and fluorescent lighting fixtures, and prior to completion of the Project, perform a burn in test of the lights. The burn in test shall consist of operating the fixtures continuously for a minimum of forty-eight (48) hours. Replace lamps that are inoperative or that show signs of flicker or color wander. If building power is not available for the burn in test, then provide a portable generator, fuel, and temporary connections for the stipulated period.

E. Provide final touchup painting to repair fixture finishes which are nicked or marred during installation. Obtain the paint from the fixture manufacturer.

3.2 AUDIBILITY

A. Fixtures shall be free from any undesirable hum, vibration, or noise. Provide lighting equipment suitable for the intended ambient sound levels. Where necessary to meet this criteria, provide additional means of sound deadening, whether or not specifically indicated. Fixtures that are found to be unsatisfactory in the opinion of the Owner shall be removed and replaced at the Contractor's expense.

3.3 SUPPORTS AND BLOCKING

A. Provide hangers, suspension cables, and blocking for lighting fixtures that will provide support independent of suspended ceilings, ceiling or wall surfaces, and electrical outlet boxes. Exception: Fixtures less than 12 inches in all dimensions and weighing less than six pounds may be permitted to be supported from the electrical outlet box if the box itself is independently supported by blocking or hangars.

B. Refer to the Drawings for specific blocking details and seismic mounting details for lighting fixtures.

3.4 OBSTRUCTIONS

A. Verify throughout the Project that mounting locations and suspension systems remain free of obstructions. Suspended or pendant mounted fixtures must be free to swing 45 degrees in all directions without hitting obstructions or other fixtures. Provide seismic rated swivel ball hangars for pendant mounted lighting fixtures to achieve the proper swing.

END OF SECTION

SECTION 31 20 00

EARTHWORK

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

D. The Design-Builder shall provide all materials, equipment, and labor necessary to perform and complete all earthwork as shown on the Drawings and as specified herein.

E. The work of this Section includes all earthwork required for construction of the project. Such earthwork shall include, but may not necessarily be limited to, site preparation, rough grading, the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the work; the supporting of structures above and below the ground; all backfilling around structures and all backfilling of trenches and pits; the disposal of excess excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Division 1 – General Requirements

B. State Codes:

1. California Labor Code.
2. Construction Safety Orders of the State of California.

C. State of California (Caltrans) Standards:

1. Standard Specifications:
   Section 25 – Aggregate Subbases. Section 26 – Aggregate Bases.
   Section 88 – Engineering Fabrics
2. CMM "Materials Manual"

D. Commercial Standards:

1. ASTM C 117 Test Method for Materials Finer than 75-□m (No. 200) Sieve in Mineral Aggregates by Washing.
2. ASTM C136 Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM D 422 Test Method for Particle-Size Analysis of Soils.
4. ASTM D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb Rammer and 12-in Drop.
5. ASTM D 1556 Test Method for Density of Soil in Place by the Sand-Cone Method.
6. ASTM D 1557 Test Methods for Moisture-Density Relations of Soils and Soil- Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
7. ASTM D 1633 Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
8. ASTM D 2419 Method for Sand Equivalent Value of Soils and Fine Aggregate.
9. ASTM D 2487 Test Method for Classification of Soils for Engineering Purposes.
10. ASTM D 2844 Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
11. ASTM D 2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
12. ASTM D2991 Test Method for Density of Soil in Place by Nuclear Methods
13. ASTM D 3017 Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
14. ASTM D 3776 Test Methods for Mass per Unit Area (Weight) of Woven Fabric.
15. ASTM D 3786 Method of Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
16. ASTM D 4253 Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
17. ASTM D 4254 Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
18. ASTM D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
19. ASTM D 4491 Test Methods for Water Permeability of Geotextiles by Permittivity.
20. ASTM D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles.
21. ASTM D 4751 Test Method for Determining the Apparent Opening Size of a Geotextile.
22. OSHA Occupational Safety and Health Administration.

1.3 CONTRACTOR SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.

B. The Design-Builder’s attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. The Contractor, prior to beginning any trench or structure excavation 5 feet deep or over, shall submit to the Engineer for review for compliance with Section 6705 the Contractor’s detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, or other provisions for worker protection against the hazard of caving ground during the excavation of such trenches or structure excavation. If such plan varies from the shoring system standards established in the Construction Safety Orders of the State

of California, such alternative system plans shall be prepared, stamped and signed by a civil or structural engineer licensed in the State of California at the Contractor's expense.

C. Certificates of Compliance: Certificates of Compliance shall be provided for all products and materials proposed to be used under this Section.

D. For all materials that are not pre-approved by the District the Contractor shall designate the source and/or submit samples of all materials in advance of their use for required testing and Engineer's approval. All testing costs shall be at the Contractor's expense.

E. No excavation beyond 5 feet is anticipated. In the event excavation is required more than 5 feet, or more in depth, the subcontractor shall submit a shoring plan in accordance with the requirements in Section 02 16 00, Shoring and Trench Safety.

1.4 QUALITY ASSURANCE

A. General: All soils testing will be done by a testing laboratory of the Owner's choice at the Owner's expense except as otherwise specified in Paragraph 1.05 C. below.

B. Where soil material is required to be compacted to a percentage of maximum density the maximum density at optimum moisture content will be determined in accordance with ASTM D 1557. Where cohesionless, free draining soil material is required to be densified to a percentage of relative density the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 2922, or by such other means acceptable to the Engineer.

C. In case the first test of the fill or backfill show non-compliance with the requirements the Contractor shall accomplish such remedy as may be required to ensure compliance. Subsequent re-testing to show compliance shall be at the Contractor's expense.

D. The Contractor shall notify the Engineer at least 48 hours prior to performing any excavation.

E. Field Measurements: Verify that survey benchmark and intended elevations for the work are as indicated.

PART 2 - PRODUCTS

2.1 SUITABLE BACKFILL AND FILL MATERIALS

A. Suitable Backfill shall be a selected or processed clean, fine earth, rock, or sand, free from objectionable material, vegetation, or other deleterious substances.

B. The following TYPES of backfill materials are designated and defined as follows:
1. TYPE 1. Sand shall be material with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a No. 4 sieve, and a sand equivalent value not less than 30.

2. TYPE 2. Class 2 Aggregate Base shall be crushed rock aggregate base material meeting the requirements of Section 26, “Aggregate Bases, “for ¾-inch maximum grading of the Caltrans Standard Specifications.
3. TYPE 3. Class 1, Type A or B, Permeable Material shall be crushed stone, or gravel, durable and free from slaking or decomposition under action or alternate wetting or drying, uniformly graded, and shall meet the requirements of Section 68-1.025 for Class 1, “Permeable Material,” of the Caltrans Standard Specifications.
4. TYPE 4. Class 2 Permeable Material shall be crushed rock or gravel, durable and free from graded, and shall meet the requirements of Section 68-1.025 for Class 2 "Permeable Material," of the Caltrans Standard Specifications.
5. TYPE 5. Manufactured Backfill shall be manufactured, angular, granular, crushed rock, concrete, or slag with 100 percent passing a one-inch sieve and less than one percent passing a No. 4 sieve.
6. TYPE 6. Controlled Low Strength Materials (CLSM) shall conform to the requirements of Section 02 32 00 "Controlled Low Strength Materials (CLSM)."
7. TYPE 7. Native material shall be material obtained from on-site excavations, provided the materials are not classified as unsuitable. Native material shall be free of stones, lumps, broken concrete or bituminous surfacing over 2 inches in diameter, objectionable material, vegetation, and deleterious substances. Additionally, all native material used as compacted fill shall meet the same property requirements as for Engineered Fill specified in this specification under Type 10.
8. TYPE 8. Topsoil material may be selected excavated material, graded, free of roots, rocks larger than 4 inches, subsoil, debris, and large weeds.
9. TYPE 9. Aggregate Subbase shall conform to the grading and quality requirements of Section 25, “Class 2 Aggregate Subbase” of the Caltrans Standard Specifications.
10. TYPE 10. Engineered Fill or import soil used as engineered fill shall consist of a soil or soil-rock mixture that meets the material properties given below:
    a. Free of rock in excess of 2 inches in size.
    b. Free of organics, debris or other deleterious materials.
    c. Free of recycled materials such as asphalt concrete, concrete, bricks etc.
    d. Granular in nature, well graded, and contains sufficient binder to allow utility trench to stand open.
    e. Plasticity Index of 4 to 12.
    f. Non-expansive with R-value of 30 minimum.

2.2 UNSUITABLE BACKFILL AND FILL MATERIALS

A. Unsuitable soils for backfill material shall include soils which, when classified under ASTM D 2487, fall in the classifications of Pt, OH, or OL. Types CH and MH soils will be permitted in unimproved areas only where required compaction and stability can be demonstrated. In addition, any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use shall be classified as unsuitable material.

B. Any material determined to be hazardous is defined as unsuitable material.

C. Washed, smooth rock (pea gravel) is classified as unsuitable material.

2.3 USE OF SUITABLE BACKFILL AND FILL MATERIAL TYPES

A. The Contractor shall use the types of materials as designated herein for all required backfill construction.

B. Backfill material types shall be used in conformance with the following provisions:

1. Over-excavation backfill shall be material with 100 percent passing a 2-inch sieve, 90 to 100 percent passing a 1-1/2-inch sieve, 5 to 30 percent passing a 3/4-inch sieve, 5 to 20 percent passing a 3/8-inch sieve and 0 to 4 percent passing a No. 200 sieve. Over-excavation backfill shall be completely wrapped with geotextile fabric.
2. Bedding backfill, as defined under PART 3 - EXECUTION of this Section herein, shall be Sand, Class 2 Aggregate Base, Class 1 Type A Permeable Material, or Class 2 Permeable Material, meeting the requirements of Product Types 1, 2, 3A, or 4.
3. Pipe Zone backfill, exclusive of bedding, as defined under PART 3 - EXECUTION of this Section herein, shall be Class 2 Aggregate Base, Class 1 Type A Permeable Material, Class 2 Permeable Material, or Manufactured Backfill, meeting the requirements of Product Types 2, 3A, 4, or 5.
4. Trench Zone backfill, as defined under PART 3 - EXECUTION of this Section herein, shall be Class 2 Aggregate Base or CLSM, meeting the requirements of Product Types 2 or 6.
5. Final Zone backfill, as defined under PART 3 - EXECUTION of this Section herein, shall consist of the following materials for each condition listed below.
    a. Final Zone backfill under paved areas shall be Class 2 Aggregate Base, CLSM, or Class 2 Aggregate Subbase, meeting the requirements of Product Types 2, 6, or 9.
    b. Final Zone Backfill in unimproved areas shall be Native or Class 2 Aggregate Subbase meeting the requirements of Product Types 7 or 9.
    c. Final Zone backfill in landscape areas shall be Native meeting the requirements of Product Type 7. Topsoil and amendments shall be Product Type 8.
    d. Final Zone backfill under graveled roads shall be Class 2 Aggregate Base, CLSM, Native, or Class 2 Aggregate Subbase, meeting the requirements of Product Types 2, 6, 7, or 9.
6. Structures. Backfill materials around structures shall be Class 2 Aggregate Base, Native, Class 2 Aggregate Subbase, or Engineered Fill, meeting the requirements of Product Types 2, 7, 9, or 10.
7. Fill. Fill materials shall be Native or Engineered Fill, meeting the requirements of Product Types 7 or 10.
8. Pavement Base Course. Backfill materials under pavement base course shall be Class 2 Aggregate Base or Class 2 Aggregate Subbase, meeting the requirements of Product Types 2 or 9.
9. CLSM shall be used where compaction cannot be achieved by mechanical means. WETA's Representative has the authority to direct the Contractor to use controlled density fill in these situations.

2.4 GEOTEXTILE FABRIC

A. Geotextile fabric shall be non-woven synthetic fabric meeting the requirements of Section 88-1.03, “Filter Fabric,” of the Caltrans Standard Specifications. Filter fabric shall be non- woven synthetic fabric with a minimum Grab Strength of 150 pounds; a minimum Burst Strength of 300 pounds, a minimum Puncture Strength of 80 pounds, a Water Flow Rate of at least 40 gal/min/sf, and an Apparent Opening Size of between 60 and 70.

2.5 STEEL PLATE

A. When steel plate bridging is provided in-lieu of backfill and temporary asphalt, it shall conform to Section 602.1 of the Caltrans Encroachment Permit Manual, with the following minimum thicknesses:

Trench Width	Minimum Plate Thickness
(10") 0.25 m	(1/2”) 13 mm
(1' - 11") 0.58 m	(3/4”) 19 mm
(2' - 7") 0.80 m	(7/8”) 22 mm
(3' - 5") 1.04 m	(1”) 25 mm

For spans greater than 5 feet-3 inches, a structural design shall be prepared by a California registered civil engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. Where abandoned underground structures are encountered in the street areas, remove to sufficient depth to allow underground lines to cross, backfill and compact during rough grading. The Engineer may require further work to be done if visual inspection indicates during construction.

B. Regulatory Requirements: Conform to applicable codes and all local, state and federal regulations for disposal of debris and use of herbicides. Burning of debris, lumber or scrap will not be permitted.

C. Preparation:

1. Sawcut paving, curbs gutters and other structures between portion to remain and portion to be removed.
2. Identify required lines, levels, contours, and datum.
3. All areas that will receive engineered fill should be stripped or organics (e.g., shrubs, weeds, grasses, root systems, etc.) and any manmade deleterious materials, down to relatively undisturbed, native materials. Resultant holes created by removal of these objects should be cleared of loose material and dished to provide access for compaction equipment.
4. All areas that will receive engineered fill should be scarified to a minimum depth of 8 inches, moisture conditioned to a soil moisture content between 2 and 6 percent over optimum and recompacted to a minimum relative compaction of 90 percent as determined by ASTM D1557. If subsurface shrinkage cracks are present, the depth of scarifying and moisture conditioning should extend to the maximum depth of cracking.

D. Protection:

1. Locate, identify, and protect utilities that remain, from damage.
2. Protect trees, plant growth, and features designated to remain, as final landscaping.
3. Protect benchmarks and existing structures which are to remain from damage or displacement.

E. Clearing:

1. Clear areas required for access to site and execution of work.
2. Remove paving, curbs, and gutters, fences, posts, or structures indicated on the drawings.
3. Remove trees and shrubs indicated. In areas to be filled and under structures and roads, remove stumps, and main root system to a depth of not less than 24 inches below the original ground surface. Depressions made by grubbing are to be filled with structural backfill to the original surface in accordance with this section, Backfilling, unless further excavation is required.
4. Clear undergrowth and dead wood, without disturbing subsoil.
5. Apply herbicide approved by the District to remaining stumps to inhibit growth.

F. Removal: Remove debris, rock, and extracted plant life from site.

G. Top Soil Excavation:

1. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded.
2. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion.
3. Remove excess topsoil not being reused from site.

3.2 EXCAVATION

A. General

1. Over-Excavation: When ordered by the Engineer, whether or not indicated on the Drawings, excavations shall be over-excavated beyond the depth shown and paid for as "extra work". Such over-excavation shall be to the depth ordered. The excavation shall then be backfilled to the grade of the bottom of the excavations shown on the Contract Drawings. Any over-excavation carried below the grade ordered, specified, or shown shall be backfilled to the required grade and densified with the specified material and compaction. Such work shall be performed by the Contractor at its own expense.
2. Disposal of Excess Excavated Material: The Contractor shall remove and dispose of all excess excavated material to a suitable site. The proper and legal disposal shall be the responsibility of the Contractor.
3. Machine slope banks to angle of repose or less, unless shored. In those cases where excavations are shored, soils at the site shall be considered to meet the OSHA definition of "Type C" soil for the purposes of shoring design, unless evaluated to be other than "Type C" by a registered engineer.

4. Excavation cut not to interfere with normal 45 degree bearing splay of foundations.
5. Grade top perimeter of excavation to prevent surface water from draining into excavation.
6. Hand trim excavation as needed. Remove loose matter.
7. Remove lumped subsoil, boulders, organic material and rock.
8. Notify the Project Manager promptly in writing of unexpected subsurface conditions before such conditions are disturbed and discontinue affected work in area until notified to resume work.
9. Stockpile excavated material in area designated on site and remove excess material not being reused, from site. Cover stockpiled material to protect from rain. Take preventive measures to ensure that water containing soil from excavations or stockpiles does not enter storm drains.
10. Steel Plate
    a. General: When backfilling operations of any excavation cannot be properly completed within a workday, steel plate bridging with a non-skid surface and shoring may be required to preserve unobstructed traffic flow and to protect biological resources from entering the open excavation.
    b. When steel plate bridging is required, the following conditions shall apply:
        1) Steel plates used for bridging must extend a minimum of 12 inches beyond the edges of the trench.
        2) Steel plate bridging shall be installed to operate with minimum noise.
        3) The trench shall be adequately shored to support the bridging and traffic loads.
        4) Temporary paving with cold asphalt concrete shall be used to feather the edges of the plates for plate installation in paved areas.
        5) Bridging shall be secured against displacement by using adjustable cleats, shims or other devices.
    c. Steel plate bridging and shoring in paved areas shall be installed using the following methods:
        1) Approaching plate(s) and ending plate (if longitudinal placement) shall be attached to the roadway by a minimum of 2 dowels pre- drilled into the corners of the plate and drilled 2 inches into the pavement. Subsequent plates are butted to each other. Fine graded asphalt concrete shall be compacted to form ramps, maximum slope 8.5 percent with a minimum 12-inch taper to cover all edges of the steel plates. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry or an equivalent slurry.

B. Pipeline and Trench Excavation

1. Trench Width: Unless otherwise shown or directed, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of densification selected by the Design Builder but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 12 inches. The maximum width at the top of the pipe shall be equal to the outside diameter of the pipe plus 24 inches to minimize the load on the deep sewer trench. For deep trenches,

the maximum width requirement shall not be waived without the written approval of the Engineer.

2. Subgrade: The surface of the subgrade after compaction shall be hard, uniform, smooth, self-draining, and true to grade and cross section.
3. Trench Bottom: The pipe bedding shall be given a final trim establishing grade such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Rounding out the trench bottom or bedding to form a cradle for the pipe will not be allowed. The Contractor shall excavate for bell holes and fittings.
4. Open Trench: The maximum amount of open trench permitted in any one location shall be the length necessary to accommodate the amount of pipe installed and backfilled in a single day. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate may not be waived.

C. Structure Excavation

1. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown on the Drawings or ordered by the Engineer. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures required for the removal or exclusion of water, including storm water, groundwater, and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). The limits of structure excavation shall be a minimum of 12 inches beyond the outside edge of the structure, and at a minimum no larger than necessary to facilitate backfill, compaction and testing operations. For structures poured against undisturbed soil the width of the structure wall shall be no more than 2 inches greater than specified or shown on the Drawings.
2. Except where otherwise specified for a particular structure or as directed by the Engineer, excavation shall be carried to the grade of the bottom of the structure. When directed by the Engineer, areas beneath minor structures shall be over- excavated. When such over-excavation is directed, both over-excavation and subsequent backfill to the required grade shall be performed. After over- excavation is performed and before backfill is placed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 90 percent of maximum density.

3.3 BACKFILL

A. General

1. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around nor upon any structure for a minimum of 72 hours or until the concrete has attained sufficient design strength to withstand the loads imposed, whichever is greater.
2. Except for Product Type 3B material being placed in over-excavated areas or trenches and unless specifically excepted by the Engineer, backfill shall not be placed until after all water is removed from the excavation.
3. Placing and Spreading of Backfill Materials
    a. Backfill materials shall be placed and spread evenly in horizontal layers. The backfill layers shall be evenly spread so that when compacted, each layer shall not exceed 6 inches in thickness.
    b. During spreading each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer and uniformity of moisture throughout backfill materials. Pipe Zone backfill materials shall be manually spread around the pipe so that when compacted, the Pipe Zone backfill will provide uniform bearing and side support.
    c. Where the backfill material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.
    d. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried or replaced until the moisture content is satisfactory.
    e. Backfill shall be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire roller, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type subject to review by the Engineer. Impact-type pavement breakers (stompers) will not be permitted. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or new improvements. The Contractor shall make its own determination in this regard.
    f. Material for mechanically compacted backfill shall be placed in lifts which, prior to compaction, shall not exceed the thickness specified below for various types of equipment:
        1) Vibratory equipment, including vibratory plates, vibratory smooth- wheel rollers, and vibratory pneumatic-tired rollers - maximum lift thickness of 2 feet.
        2) Rolling equipment, including sheepsfoot (both vibratory and non- vibratory), grid, smooth-wheel (non-vibratory), pneumatic-tired (non-vibratory), and segmented wheels - maximum lift thickness of 1 foot.
        3) Hand-directed mechanical tampers-maximum lift thickness of 4 inches.
    g. Mechanically compacted landfill shall be placed in horizontal layers of thickness not exceeding those specified above, compatible to the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened or dried, if necessary, and then tamped or rolled until the specified relative compaction has been attained.

B. Utility Trench Zones and Backfill

1. Trench Backfill Requirements: The pipe class has been structurally designed based upon the trench configuration previously specified herein.

a. The Contractor shall maintain the previously specified trench width up to a horizontal plane lying 12 inches above the top of the pipe.
b. If, at any location under said horizontal plane, the Contractor slopes the trench walls or exceeds the maximum trench widths indicated the Pipe Zone backfill shall be "improved" or the pipe class improved at no additional cost to the District. "Improved" backfill shall mean Control Low Strength Materials or other equivalent materials acceptable to the Engineer.
c. If the allowable deflection specified for the pipe is exceeded, the Contractor shall expose and reround or replace the pipe, repair all damaged lining and coating, and reinstall the Pipe Zone material and Trench Zone backfill as specified.
d. All trenches shall have a minimum of 2 inches of temporary asphalt placed daily and maintained unless final paving can be completed in the same day. Temporary asphalt shall be placed flush with adjacent pavement grade.
e. Steel plates may be used to cover open trenches in-lieu of backfill and temporary asphalt pavement.
f. For any new pipeline installation that crosses under an existing electric, gas, telephone, or cable TV utility pipe(s) or conduit(s) the Contractor shall replace the existing backfill material around the existing utility pipe(s) or conduit(s) with sand. Sand shall be placed from a plane 6 inches below the bottom of the lowest utility pipe or conduit to a plane 12 inches above the top of the highest utility pipe or conduit, and for the full width of the new trench. Sand backfill shall be compacted to 95 percent maximum density in conformance with Paragraph 3.5, Compaction, as specified below. For any new pipeline installation crossing under existing storm or sanitary sewer, the contractor shall replace existing backfill material with controlled low strength material per the Contract Drawings.

2. Bedding: The bedding is defined as that portion of the Pipe Zone lying between a plane 6 inches below the bottom surface of the pipe, the trench subgrade, and a level line from the bottom of the pipe.
   a. Class C Bedding shall be provided for all pipelines.
   b. After compacting the bedding, the Contractor shall perform a final trim for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.
3. Pipe Zone and Backfill:
   a. The Pipe Zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe, i.e., the trench subgrade, and a plane at a point 12 inches above the top surface of the pipe.
   b. The Pipe Zone shall be backfilled with the specified backfill material. The Contractor shall exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.
4. Trench Zone and Backfill: After the Pipe Zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the Trench Zone may proceed.
5. The Trench Zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a plane at a point 24 inches below the roadway subgrade in paved areas, or 24 inches below the finished surface grade in landscaped or unimproved areas.

6. Final Zone and Backfill: The Final Zone is defined as the last 24 inches between the top of the Trench Zone and the roadway subgrade in paved areas, and the last 24 inches of the vertical trench cross-section lying between the top of the Trench Zone and the finish final grade in landscaped or unimproved areas.

C. Minor Structure Backfill (Approach Ramp)

1. Subgrade Preparation: For construction of the equipment approach ramp, it is imperative that the mat foundation be supported by a minimum of 3 feet of native or engineered fill compacted as specified in Section 3.5.
2. If ramp subgrade soils have been allowed to dry out (i.e., are no longer at a moisture content between 2 and 6 percent above optimum as determined by ASTM D1557), then the subgrade shall be saturated by controlled flooding prior to ramp construction.

D. Major Structure Backfill

1. Preparation:
   a. If the excavation subgrade contains soft soils or if the subgrade becomes softened due to construction equipment or inadequate/incomplete groundwater cut off and/or dewatering, the soft soil should be removed (i.e., over excavated).
   b. A geotechnical engineer shall observe and document the condition of the excavation subgrade prior to construction of the pump station mat foundation in order to assure that the foundation is located within the bearing material for which it is designed and to determine if any over- excavation is required.
   c. Generally compact subgrade to density requirements for subsequent backfill materials. Cut out soft areas of subgrade not capable of in situ compaction. Backfill with the type of material indicated on the drawings and compact to density equal to or greater than requirements for subsequent backfill material.
2. Employ a placement method that does not disturb or damage foundation perimeter drainage or foundation waterproofing.

3.4 FILL

A. Place and compact material in continuous layers not exceeding 8 inches compacted depth.

B. Make grade changes gradual. Blend slope into level areas.

C. Along the outer perimeter of the site (i.e., in the transition area between the finished elevated site grade and the existing grade of the surrounding field), fill slopes should be no steeper than 3H:1V (3 horizontal to 1 vertical). Fill slopes should be overbuilt and then trimmed back to expose compacted engineered fill. Compaction by track walking of slopes should not be allowed.

D. Remove surplus fill materials from site.

E. Tolerances

1. Top Surface of Subgrade: Plus or minus 1/10 foot in 10 feet.

F. Field Quality Control

1. Field inspection and testing will be performed under provisions of Division 1.
2. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D1557.
3. Compaction testing will be performed in accordance with the appropriate referenced ANSI/ASTM Standards.
4. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to the Owner.
5. Frequency of Tests: One per 1,000 cubic yards but not less than one per layer of fill and not less than one per day.

3.5 COMPACTION

A. General

1. Each layer of backfill or fill material as defined herein, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content range.
2. Flooding, ponding, or jetting shall not be used.

B. Compaction of Trench and Structure Backfill Materials

1. Compaction Requirements: The following compaction test requirements shall be in accordance with ASTM D 1557 for cohesive type materials and in accordance with ASTM D 4253 and D 4254 for “non-plastic” cohesionless free draining granular type materials.
2. Where other agency or utility company requirements govern, the highest compaction standards shall apply.

Location or Use of Fill	Percentage of Maximum Density	Percentage of Relative Density
Pipe Zone backfill including bedding and overexcavated zone	90	65
Final Zone backfill beneath paved areas or structures	95	70
Final Zone backfill beneath unpaved access areas, landscape, or unimproved areas	90	55
Trench Zone backfill	90	65
Backfill beneath structures	95	70
Backfill around structures	90	65

Maximum density refers to maximum dry density according to ASTM D 1557 laboratory test procedures. Percentage of Relative Density refers to ASTM D 4253 and ASTM D 4254 laboratory test procedures. Relative density should only be used for “non-plastic” cohesionless free draining, granular-type materials.

C. Compaction of Fill Place and compact materials in continuous layers not exceeding 8 inches compacted depth, compacted to 95% of maximum density at 2 percent over optimum water content.

END OF SECTION

SECTION 31 23 19

DEWATERING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 SUMMARY

A. Section Includes:

1. Dewatering, depressurization, draining and maintaining trenches, excavations and foundation beds in a stable condition.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Division 01, Administrative Requirements and Submittals.

B. Administrative Submittals:
1. Discharge permits.

PART 2 - PRODUCTS (NOT USED)

PART 3 - PART 3 EXECUTION

3.1 GENERAL

A. Continuously control water during course of construction, including weekends and holidays and during periods of work stoppages, and provide adequate backup systems to maintain control of water.

3.2 SURFACE WATER CONTROL

A. Remove surface runoff controls when no longer needed.

3.3 DEWATERING SYSTEMS

A. Provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in dry and to lower and maintain groundwater level below the lowest point of excavation. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

C. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.

3.4 DISPOSAL OF WATER

A. Obtain discharge permit for water disposal from authorities having jurisdiction.

B. Treat water collected by dewatering operations, as required by regulatory agencies, prior to discharge.

C. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.

D. Remove solids from treatment facilities and perform other maintenance of treatment facilities as necessary to maintain their efficiency.

3.5 PROTECTION OF PROPERTY

A. Make assessment of potential for dewatering induced settlement. Provide and operate devices or systems necessary to prevent damage to existing facilities, completed Work, and adjacent property.

B. Securely support existing facilities, completed Work, and adjacent property vulnerable to settlement due to dewatering operations. Support shall include, but not be limited to, bracing, underpinning, or compaction grouting.

END OF SECTION

SECTION 31 62 16

STEEL PIPE PILES

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

This Section provides the minimum requirements for fabrication, testing, inspection, and installation of all steel pipe piles, including fiberglass cap at the top of piles, as indicated on the Construction Drawings (drawings) and specified herein.

This specification pertains to the following:

A. Float guide piles
B. Donut fender piles
C. Approach way support steel piles

1.3 RELATED SECTIONS

A. Section 35 59 13 - Donut Marine Fender System

B. Section 05 12 00 - Structural Steel Framing

C. Section 09 97 13 - Steel Coatings

1.4 REFERENCES

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

A. American Petroleum Institute (API)

1. API 5L Specification for Line Pipe

2. API 2B Specification for Fabrication of Structural Steel Pipe

B. American Welding Society (AWS)

3. AWS A5.1 Specification for Carbon Electrodes for Shielded Metal Arc Welding

4. AWS D1.1 Structural Welding Code - Steel

C. American Society for Testing and Materials (ASTM)

5. ASTM A36 Standard Specification for Carbon Structural Steel

6. ASTM A252 Standard Specification for Welded and Seamless Steel Pipe Piles

7. ASTM A370 Standard Test Methods and Definitions for Mechanical Testing of Steel Products

8. ASTM A537 Standard Specification for Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel

D. Military Specifications

9. MIL-A-18001 Anodes, Sacrificial Zinc Alloy

1.5 GEOTECHNICAL INVESTIGATION AND FOUNDATION RECOMMENDATIONS

A. For float guide pile and donut fender pile embedment at the site, refer to the construction drawings. For supplemental engineering information pertaining to the float guide pile and donut fender piles see Appendix A, Geotechnical Report provided by ENGEO as a reference document.

B. For known site conditions, see the site boring logs.

C. Subsurface Debris and Ground Improvement: The Contractor is alerted to the possibility of encountering old debris during pile driving. The Contractor is required to investigate the area where all piles will be driven and be prepared to deal with debris. The area where the pier piles are to be driven will be subject to ground improvement. Contractor to sequence work to install the piles without damage.

D. Anticipated Construction Sequence for Float Guide Piles, Donut Fender Piles and Approach Way Support Piles– Steel pipe piles will be vibrated down to the tip elevation as required by the design.

1.6 PERMITS

Piles shall be installed in compliance with all applicable local, state and federal environmental requirements.

1.7 SUBMITTALS

All submittals shall be in accordance with Specification Section 01 33 00 - SUBMITTALS.

A. Pile Installation Plan - Describe the method of transporting, handling, and installing piles, including marine equipment to be used and sequence of installation.

Restrictions as shown on the Construction Drawings shall be included in the plan. Submit plan at least thirty (30) days prior to delivery.

B. Submit technical data for all pile driving equipment proposed for use and a Wave Equation Analysis for the proposed pile and driving equipment. The Wave Equation shall be used to assess the ability of the proposed driving system to install the pile within the allowable driving stresses.

C. No later than the time of delivery of materials to the site, submit steel certificates for review.

D. Submit plan for PDA testing including PDA equipment specifications, access to preliminary field PDA results for the Owner during driving, and a formal PDA report with CAPWAP analysis for each pile tested.

E. Submit pile driving log for each pile driven with recorded blows per inch for the last one foot of driving and blows per foot for the remainder of the driven length. Log should indicate all pertinent data related to the pile driving activity.

F. Provide a minimum of five (5) days' notice to the Owner prior to driving any piles. Notify the Owner of any changes in the schedule.

G. Pile Placement Sequencing - Detail the installation sequence of the piles and the method proposed for controlling the location and alignment of piles, installing the piles through Bay Mud into soil while maintaining pile plumb.

H. Shop Drawings:

1. Steel pipe piles: Show all locations, markings, layouts, materials, sizes, and shapes and indicate all methods of connection and bracing. Submit detail drawings of pile splices prior to fabrication.

2. Field splice details: Stabbing points, blocks, shims, etc. required to align pile sections when working flat and in the leads.

3. Pile installation template and installation procedure.

4. Cathodic protection system.

5. Pile top: cover cone

I. Manufacturers Product Data:

1. Welding electrodes and rods.

2. Coating system.

3. Cathodic protection anodes.

J. Testing and Inspection Reports.

K. Certificates: Submit certification from manufacturers, suppliers, fabricators, etc. attesting that the following conform to the requirements:

1. Steel pipe piles
2. Welding electrodes and rods
3. Welding procedures and qualifications
4. AISC Quality Certification. Alternatively, AISC Quality Certification may be waved for a steel pipe fabricator that has provided steel pipe piles for other WETA projects; in this case the required submittals are A. a copy of their QA/QC procedures equivalent to AISC quality criteria and B. a list of the other WETA projects where the QA/QC plan was applied.
5. Coating System (per Section 09 97 13 - STEEL COATINGS)
6. Paint marking compatibility approval by coating manufacturer.
7. Steel Plate Fabricator's Association (SPFA) certification when plates are used to fabricate pipe.

L. Pile Drivability Analysis

M. Hydro-acoustic and Above-Water Monitoring Plan - Submit a detailed hydro-acoustic, above- water, and biologic monitoring plan, conforming to project requirements for review.

N. Pile Delivery and Handling Plan

O. Pile Installation Records

1. Submit the proposed form for compiling pile driving records 30 days prior to commencement of work.
2. Submit complete and accurate pile installation records within fifteen (15) calendar days after completion of installation.

1.2 TESTING AND INSPECTION

A. Testing and inspection of the steel pipe piles shall be performed in accordance with the requirements in AWS D1.1. Hydrostatic testing may be omitted.

B. Welder Qualifications shall be in accordance with the requirements in Contract Specification Section 05 12 00 – STRUCTURAL STEEL FRAMING

C. Shop Inspections

1. The fabricator shall perform, at his expense, normal quality control procedures in accordance with AWS D1.1, industry standards and his quality control manual. The Owner shall be allowed access to all parts of the Work at all times and shall be furnished such information and assistance by the Contractor and fabricator as may be required for a complete and detailed inspection.

2. Special inspections shall be provided and performed by Contract and approved by Owner's Representative in accordance with 2013 California Building Code Chapter 17 and the requirements herein.

3. Fabrication inspection for pipe piles at the manufacturing plant are as follows:

    a. Extent – Non-spirally welded pipe, for each pipe:

        i. 100 percent VT all welds, both sides. If they fail to meet the tubular connections criteria of AWS D1.1 Table 6.1, they must be repaired.

        ii. For each straight length of weld, UT or RT inspect 100 percent of length of circumferential and 10 percent of length of longitudinal welds, and MT or PT inspect 20 percent of length of circumferential welds. For circumferential welds, distribute MT or PT inspection equally to each side of weld, 20 percent each inspectable side or face. For each straight length of weld, if no defects (rejectable indications) are found, no further inspection of that weld length is required.

        iii. If one or more subsurface defects are found, UT or RT the remainder of the circumferential weld with defect(s), and another 10 percent of longitudinal weld with defect(s). If one or more subsurface indications are found in the longitudinal weld, inspect the remainder of the weld.

        iv. If one or more surface defects are found, MT or PT inspect another 20 percent of the circumferential welds and 10 percent of the longitudinal welds. If one or more surface defects are found, MT or PT inspect the remainder of the weld.

    b. Extent – Spirally welded pipe, for each pipe:

        i. 100 percent VT all welds, both sides. If they fail to meet the tubular connections criteria of AWS D1.1 Table 6.1, they must be repaired.

        ii. 20 percent UT or RT and 10 percent MT or PT the length of spiral weld and plate splice welds (MT 10 percent each inspectable side or face). If no defects are found, no further inspection is required. For MT or PT, inspect both sides of weld.

        iii. If one or more subsurface defects are found, UT or RT inspect another 25 percent of the weld. If one or more subsurface defects are then found, inspect the remaining length of weld.

        iv. If one or more surface defects are found, MT or PT inspect another 25 percent. If one or more surface defects are found, inspect the remaining length of weld.

        v. When choosing portions of weld lengths to inspect, choose the length that appears most likely to contain defects. If this is not obvious, randomly select.

        vi. MT or PT surface inspection is total per length and by side or face.

vii. If no defects are found in the first four pipes inspected, inspect the next four by VT, but only two of the four with MT and UT as described above. If no defects are found, inspect the next four by VT, but only one of the next four by MT and UT. If no defects are found, inspect the next eight, by VT, but only one of the eight by MT and UT. If no defects are found, repeat with the next eight. When defects are found, restart VT, MT, and UT inspection on each of the next four pipes.

viii. Repaired weld lengths shall be inspected at 100 percent VT, MT or PT, and UT or RT. Welds with surface defects that did not fail UT or RT are not required to be UT or RT after they are repaired.

ix. The Contractor shall be responsible for performing fabrication / erection / inspection at the pile manufacturing plant, as defined above.

x. At the Contractor's option, inspection will be witnessed by the Contractor's Welding Inspector in conformance with the requirements of API 5L, Appendix H.

xi. Records verifying that this testing was accomplished and that all tested welds were in conformance with these specifications shall be submitted with the manufacturer's mill certificate.

B. Field Inspections

1. After welds are completed, they shall be hand or power-brushed and thoroughly cleaned by the Contractor before field inspection.

2. The Owner will perform 100 percent visual inspection of welding, in accordance with AWS D1.1.

3. The Owner will engage the services of an independent inspector/laboratory to perform the ultrasonic testing.

4. Ultrasonic testing will be performed in accordance with AWS D1.1 and the requirements herein to augment the visual inspection of all pile splice welds.

5. Field splice weld inspection requirements for pipe piles follows:

a. Butt splice welds shall be nondestructively tested (NDT) from the outside in conformance with the requirements of AWS D1.1 as follows:

i. 100 percent VT.

ii. 100 percent MT or PT

iii. 100 percent RT or UT

C. Correction of Defective Shop or Field Welds: Weld areas which contain defects based on AWS D1.1 shall be repaired in accordance with AWS D1.1 paragraph 5.26 by the Contractor at his expense. The repair shall conform to the requirements of AWS D1.1/D1.1M, Section 6, for cyclically loaded non-tubular connections subject to tensile stress. When pipe pile welds are VT and fail to meet the tubular connections criteria of

AWS D1.1 Table 6.1, they must be repaired. When pipe pile shop welds or field splices are UT tested or are repaired and retested, the Discontinuity Severity Classes A through D are as shown in AWS D1.1 Table 6.3 and the rejection/ acceptance criteria for the different classes are as indicated on that page of D1.1.

D. Repair of the Coating System: Repair of the Coating System shall be at Contractor's expense and in accordance with coating manufacturer's instructions.

E. Testing of Mechanical Properties: Results of testing material properties shall be in accordance with the material property specification used to fabricate the pipe piles (e.g., API 5L, ASTM 252). In addition, results of the following tests are required before the installation of piles can begin:

1. Tensile Tests:

a. Test Specimens: Tensile test orientation shall be relative to the pile. At the option of the manufacturer, the specimen may be either full section, strip specimen or round bar specimen. The tensile testing procedure shall conform to the requirement of ASTM A370, Methods and Definitions for Mechanical Testing of Steel Products.

b. Frequency: Tensile tests shall be made at the frequency of one pile per each pile size.

c. Longitudinal Tensile Tests: At the option of the manufacturer, longitudinal tests may utilize a full specimen, or for pipe with a wall thickness greater than ¾ in., a ½ in. diameter round bar specimen. The strip specimen shall be tested without flattening.

d. Transverse Tensile Tests: The transverse tensile properties shall be determined as follows: The yield strength, ultimate strength and elongation values shall be determined on a flattened rectangular specimen. The same method of testing shall be employed for all lots for a given pile diameter and wall thickness. All specimens shall represent the full wall thickness of the pipe from which the specimen was cut.

e. Weld Tensile (Reduced Section Tension) Tests: The weld tensile test specimens shall be taken at 45 degrees to the weld with the weld at the center and shall represent the full wall thickness of the pipe from which the specimen was cut. Weld reinforcement shall not be removed unless directed by Owner's Representative.

2. Guided – Bend Tests:

a. Test Specimens: The test specimens shall be taken from the spiral welded pipe of each combination of outside diameter and wall thickness containing skelp weld ends. The specimens shall not contain repair welds. Tests shall be in accordance with AWS D1.1, Clause 4. One test per each pilesize.

b. Charpy V-Notch shall be performed conforming to the requirements of the API 5L.

F. Pile Installation Observation: Pile installation shall be performed under the continuous observation of a Geotechnical Engineer licensed as a GE in the State of California to

confirm that the driving and coring conditions are similar to those expected based on the soil conditions used in the pile design.

1.3 PRODUCT HANDLING

A. Use all means necessary to protect steel piles before, during, and after installation and to protect the installed work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacement necessary and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Pipe Piles

1. All steel pipe pile material used for float guide piles, donut fender piles, approach way support piles to be:

a. The steel pipe pile size and material shall be as specified on the Contract Drawings or equivalent as accepted by the Owner. Steel material shall be ASTM A252, Grade 3 with a minimum Fy = 50 ksi. Pile length shall be as shown on the Contract Drawings.

b. Pipe piles shall have a minimum wall thickness as noted on the Drawings.

c. The tips of pipe piles shall be fitted with open-end cutting shoes, Part Number 0-14000, as manufactured by Associated Pile and Fitting, LLC or equivalent accepted by the Owner, unless noted otherwise.

2. All pipe material shall be new. Provide mill certificates for pipe pile materials.

B. Pile Cover Cones: Round Fiberglass cap with minimum thickness of 1/8" wall to fit 36" diameter guide piles and donut fenders piles. The length of the cone over pile to be 8 inches minimum.

2.2 FABRICATION

A. STEEL PIPE PILES

1. Pipe piles may be manufactured with longitudinal seam or helical (spiral) seam.

Fabricator of steel pipe shall be certified by the Steel Plate Fabricator's Association (SPFA) when plates are used to fabricate pipe. Pipe piles shall be fabricated in accordance with one of the following standards (neglecting any requirements that welds be longitudinal), and the additional requirements in this specification:

i. API 5L PSL 1 or PSL2 (hydrostatic testing not required)

ii. ASTM A252 with geometry meeting API requirements

2. Welding shall be performed in accordance with the requirements in Contract Specification Section 05 12 00 – STRUCTURAL STEELFRAMING.

3. At the float guide piles, spiral, longitudinal, and butt welds above Mean Lower Low Water must be ground flush with the pile face. At the donut fender piles, spiral, longitudinal, and butt welds from 9'-6" below Mean Lower Low Water to the pile top must be ground flush with the pile face.

4. Fabrication Tolerances:

   a. Overall length +/- 3 inches.

   b. Deviation from a straight line shall not exceed 0.1 percent along the entire length of pile.

B. PILE SPLICES

1. Submit detail drawings of shop and field splices prior to fabrication.
2. Perform all welding in accordance with the requirements for shield metal arc welding of AWS D1.1. Submit welding procedure for shop splices and verification of welder certification and qualifications. Make no more than one field splice per 60 feet of pile, unless directed by the Engineer. Fabrication drawings must show all shop splices.
3. Splice sections of pipe with an approved full penetration butt or single bevel-groove weld. Both pipe ends must be square cut and seated to bear. Use an approved jig or alignment device during welding to maintain the required straightness of pipe.
4. Field splices must be minimized or eliminated if possible. No splices will be allowed in the top 25 feet of pile to eliminate coating vulnerability. For splices made during pile installation, rigid frame pile leads may be used as a jig in a manner approved by the Engineer.
5. Weld Bead Height: The weld bead height shall not be greater than 3/16 inch typically and shall be ground flush with outer wall per paragraph 2.2 within portion of length bearing with UHMW elements of donut fender piles and float guide piles. Refer to the drawings.

6. Misalignment: Misalignment of the weld beads shall not exceed 1/8 inch. This applies only to double-sided welded pipe.

2.3 PILE MARKING

A. Mark piling with lines at one-foot intervals from tip to top. Number every 5 ft. increment. Marking should be neat in appearance.

B. Markings shall be done with high visibility paint and be clearly visible and legible to the naked eye at a distance of 75 ft.

C. Paint markings on coated pile sections shall be of material approved by the coating manufacturer.

D. Piles not properly marked will be rejected

2.4 PILE COATING SYSTEM

A. The coating system for all piles shall be in accordance with Contract Specification Section 09 97 13 – STEEL COATINGS.

B. All coating damaged during handling shall be repaired in accordance with coating manufacturer's recommendations, at Contractor's expense.

2.5 PILE INSTALLATION TEMPLATE

A. The Contractor shall provide a template to guide the piles during installation.

B. The template shall be so constructed as to achieve the installation tolerances noted herein.

2.6 CATHODIC PROTECTION

A. New brackets for bolt on zinc anodes shall be provided for the protection of submerged length of the piles from corrosion.

B. The total number and location of brackets shall be confirmed by a certified corrosion specialist, licensed in the State of California.

C. Brackets shall allow for future installation of anodes. Anode installation is not a required part of the scope of work.

D. The anode brackets shall be installed at locations shown on the Drawings.

E. The anode brackets shall be shop-installed prior to pile coating.

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Drive piles with an air, diesel, or hydraulic operated impact hammer with sufficient energy and energy transfer characteristics to drive the piles to the required toe elevations and capacity without damaging the pile head. Use care not to injure piles by over driving as would be indicated by rebound of hammer or staggering of pile. Cut off heads of piles accurately in accordance with the Contract Documents after completion of driving.

B. Rig the pile driver with fixed leads to guide the hammer from highest to lowest points of travel in a manner permitting free vertical movements of the hammer, and with leads laterally braced to assure firm support of the piles during driving.

C. The pile is to be located by temporary frames containing members of adequate size to guide and stabilize placement of the pile prior to and during driving. The frames shall be rigidly located such as to keep the pile plumb and in correct position while being driven.

3.2 PILE DRIVING

A. Drive the piles straight and true at indicated locations, with deviation from the longitudinal axis of not more than 1/4 inch per foot.

B. Locate the piles within 3 inches of the positions indicated on the Drawings.

C. Continuously drive each pile to reach the capacity and/or full embedded length called for on the Drawings.

1. Lengths shown on the Drawings are considered average values, and the actual lengths may vary when so accepted by the Owner.
2. Drive piles to achieve driving resistance penetration and refusal values as specified and as accepted by the Owner.

D. Use suitable cushions or driving heads to avoid damage to the piles, developing proper total driving energy, and directing the energy along the longitudinal center of gravity of the pile.
1. Drive piles to their full penetration without bending, rupturing, or severely damaging the piles.
2. If failure in any of the above respects is encountered, pull the pile, and drive a new pile at no additional cost to the Owner.
3. If a replacement pile fails to develop full driving resistance, pull the replacement pile, and drive a new pile with larger diameter at no additional cost to the Owner.

E. Jetting and Pre-drilling

1. Jetting to assist penetration will not be accepted unless accepted by the Owner and Engineer.
2. Approved pre-drilling to assist penetration may be used where extreme driving resistance is encountered, or where vibrations from driving may be detrimental to adjacent structures.
3. Make pre-drilled bores 80% of tip diameter and to 80% of the depth of penetration, reserving the lower phases of penetration solely for driving.

F. Where piles are pushed up by pressure from driving of adjacent piles, re-drive as required and at no additional cost to the Owner.

G. Record pile driving information, including date of installation, pile number, pile type and installed length, type of hammer and rated energy, date of installation, blow counts or minutes per driven foot/inch, and final tip elevation.

H. The Contractor shall consider the construction recommendations provided in the Geotechnical Report. The Contractor shall provide facilities as required to assist inspection of driven piles and cooperate with inspection personnel to expedite work.

I. The DB RFP Drawings indicate the estimated pipe pile length. Estimated pile lengths are approximate, based upon the Geotechnical Report and shall be confirmed by Design Team. Tip elevations may need to be adjusted based on final design and driving observations. The Geotechnical Engineer observing the pile driving shall advise.

3.3 INSTALLATION

A. Notify Owner 30 days prior to the date pile installation is to begin. Notify the Owner at least 48 hours prior to pile driving.

B. Pile lengths may be adjusted prior to driving by either cutting the pile to a reduced length or extending the pile to an increased length with a spliced segment. Either action must be performed at the tip end of the pile. The tip ends of the piles shall be shop cut-off or spliced if the pile length requires adjustment.

C. Note that in-water work is permitted to the work window and conditions described in project permits.

D. Do not install piles within 100 ft. of concrete less than 7 days old.

E. The Contractor shall survey the final location of the driven piles (after cut-off) on a weekly basis, update the Shop Drawings as required and provide the information to the Owner. Take special precautions to ensure against buckling of pile or leaning away from plumb position.

F. Care should be taken during installation to prevent and correct any tendency of piles to deviate or walk.

G. Contractor shall engage an independent testing agency to observe the production piles installation. The testing agency must be qualified according to ASTM E329 for testing indicated. Submit testing agency qualifications to the Engineer for review and acceptance.

H. Contractor shall employ a testing agency to perform the welding inspections as required by Code.

3.4 SAFE LOAD CALCULATION

A. Calculate ultimate pile capacity using WEAP analysis, PDA testing, and blow count observations. The working load will be the ultimate pile capacity divided by a factor of safety of 2.5.

3.5 HANDLING, CUTTING AND FRAMING

A. Handle piles carefully, without sudden dropping or excessive bending.

3.6 LENGTH AND LOAD REQUIREMENTS

A. Required tip elevations and/or minimum ultimate load capacities are as indicated on the Drawings.

3.7 OBSTRUCTIONS

A. The Contractor shall probe along the area of each pile to a depth of 10 ft. below mudline prior to installation of any pile. Probing shall be performed either by installation of a steel test pile or by drilling along each pile axis.

B. When probing is performed using steel test piles, the test piles may remain in place and the guide piles installed concentrically when no obstructions are encountered. When probing is performed using drilling, the minimum diameter shall be 12-inches.

C. Any obstruction encountered shall be reported to the Owner.

1. The Owner will determine whether the Contractor shall do any of the following options:
   (a) Remove the obstruction and install the pile; (b) Leave the obstruction and relocate the pile; or (c) Leave the obstruction and install the pile as the obstruction can be penetrated by the steel pipe piles.

D. If a pile encounters an underground obstruction within 5 feet of the ground surface of such size as to prevent driving the pile to the required driving criteria, the pile must be pulled or cut off at no cost to the Client. If such an obstruction is encountered more than 5 feet below the ground surface, the pile must be cut off and paid for as if a completed pile. In either event, a replacement pile must be installed at a location indicated by the Engineer and paid for as completed pile.

3.8 FIELD SPLICES

A. Field splices shall be performed only when accepted by Engineer.

B. Use minimum 3/8 in. backing rings for all field splices. Attachment of the rings to the pipe shall be performed by using the minimum size and spacing of tack welds that will securely hold the backing ring in place. Tack welding shall be performed in the root area of the weld splice, i.e., location that will be covered by the splice weld. The gap between the backing ring and the pipe shall be no greater than 5/64 in. Provide the weld detail to the engineer for approval.

C. Construct splices to maintain the true alignment and position of the pile section. Splices shall be made with complete penetration welds and shall develop the full combined strength of the pile in bending, tension, and bearing.

D. Limit the variation in edge alignment for abutting steel pipe pile ends to 0.10 times the wall thickness, with a maximum allowable variation of 0.063 in. Submit requested larger variations to the engineer for approval.

E. All field splices shall be visually inspected and tested.

F. In addition to visual inspection, 100 percent of the welds must be tested and inspected according to AWS D1.1 and inspection procedures listed below:
   1. Magnetic Particle Inspection
   2. Ultrasonic Inspection

3.9 HEAVED PILES:

1. When driving piles in clusters or under conditions of relatively close spacing, perform observations to detect heave of adjacent piles.

2. Back drive heaved piles to original depth of penetration or tip elevation without additional cost to the Owner.

3.10 PILE CUTOFF

A. The Contractor shall provide a 2-ft sacrificial length at the top of the pile to allow for damaged pile cut-off and to accurately implement the required cut-off elevations.

B. Any damage to coatings due to pile installation or cutting shall be repaired.

3.11 DAMAGED PILES

A. Do not install piles damaged or suspected of damage until inspected and approved by the Owner.

B. Pile damaged or impaired for use during driving shall be pulled and replaced with new piles as directed by the Owner without additional cost.

C. The Owner may require that any pile suspected of being damaged to be pulled for inspection.

D. Replace piles pulled as directed and found to be damaged with new piles at the Contractor's expense.

E. All repair costs for pile and coating including additional materials and labor required, shall be at the Contractor’s expense.

3.12 PILE INSTALLATION RECORDS

A. The Owner shall maintain a pile installation log provided by the Design Builder showing the following:

1. All piles shall be referenced per the numbering system shown on Contractor’s Shop Drawings.

2. Records showing that pile installations were conducted under their own Professional Geotechnical Engineer registered in the State of California.

3. Record all pile lengths as furnished and the length of pile in place. Include elevations of tip and butt before and after cutting off and tip elevation.

4. Provide as-driven survey drawing showing actual location (coordinates, elevations, and plumbness) of all piles. This shall be a drawing prepared for this record (i.e., not a copy of the Construction Drawings).

5. Record the pile penetration and the rate of penetration.

6. Include in the record the type and size of hammer and drill used. Record any unusual occurrence during pile installation.

7. If an impact hammer is required, complete pile driving, record type and size of hammer, and number of blows per foot.

END OF SECTION

SECTION 33 11 16

WATER UTILITY PIPING AND APPURTENANCES

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

A. Section Includes:
1. Pipe and fittings for potable water supply piping including domestic water.
2. Valves
3. Underground pipe markers
4. Precast concrete valve and meter boxes
5. Pipe Supports and Anchoring
6. Accessories

B. Related Requirements:
1. Section 02 41 00 – SITE DEMOLITION
2. Section 31 20 00 – EARTHWORK
3. Section 31 23 19 – DEWATERING

1.3 REFERENCE STANDARDS

A. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
3. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

B. American Water Works Association:
   1. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
   2. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
   3. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
   4. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
   5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

C. Manufacturer’s Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.

D. National Fire Protection Agency:
   1. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.4 SUBMITTALS

A. Section 01 13 00 – Administrative Requirements and Submittals: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

C. Shop Drawings: Submit shop drawings for pipe, fittings, and appurtenances. Indicate piece numbers and locations and restrained joint locations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate special procedures required to install Products specified.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 17 00 – Execution Requirements and Section 01 77 00 Closeout Procedures: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Valves: Mark valve body with manufacturer's name and pressure rating

1.7 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. Deliver and store valves in shipping containers with labeling in place.

E. Store and protect products in accordance with manufacturers' instructions.

F. Store with seals and labels intact and legible.

G. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

H. For exterior storage of fabricated products, place on sloped supports above ground.

1.8 EXISTING CONDITIONS

A. Verify field measurements prior to fabrication. Indicate field measurements on shop drawings.

PART 2 - PRODUCTS

2.1 GENERAL

A. All solid wall pipe shall be continuously and permanently marked in conformance with the appropriate ASTM.

B. The Contractor shall also require the manufacturer to mark the date of extrusion on the pipe.

C. Refer to Sections 22 11 16 “Domestic Water Piping” and 21 11 00 “FIRE-SUPPRESSION WATER-SERVICE PIPING” for piping products.

2.2 UNDERGROUND PIPE MARKERS

A. Manufacturer and Product List:
1. Reef Industries, Model Terra “D”.

B. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service. Tape color and lettering shall be in accordance with the APWA Uniform Color Code for Marking of Underground Utility Location. The identifying lettering shall be a minimum of 1-inch-high permanent black lettering.

C. Trace Wire: Electronic detection materials for non-conductive piping products.
1. Unshielded 10 AWG. THWN insulated copper wire. Taped to top pipe at 3 ft intervals for all non-metallic pipe.
2. Conductive tape.

2.3 PRECAST CONCRETE VALVE BOXES AND METER BOXES

A. Conform to City of Vallejo Standards.

2.4 BEDDING AND COVER MATERIALS

A. Unless otherwise specified or shown, all material used for pipe embedment shall be as specified in Section 31 20 00, “Earthwork”.

2.5 ACCESSORIES

A. Concrete for Thrust Restraints

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection:
1. Prior to all Work of this section, carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that all pipes may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 HANDLING

A. The Contractor shall provide and use proper implements, tools and facilities for the safe and proper handling and protection of the pipe, all as recommended by the manufacturer. Pipe shall be handled in such a manner as to avoid damage to the pipe material or any coating and especially to the ends.

B. When damaged pipe cannot be repaired to the satisfaction of the Owner, it shall be removed from the job.

C. Pipe shall be stored in a safe location, protected from the elements where damage therefrom could result.

D. The pipe shall be carefully lowered in the trench to prevent damage. Under no circumstances shall pipe be dropped or dumped into trenches. Remove foreign matter and dirt from the inside of the pipe and keep it clean during and after laying.

E. The Contractor shall take care to keep from damaging the pipe by heavy loads and unnecessary compactive effort especially for shallow lifts. All damaged pipes shall be replaced. Normally, repairs will not be acceptable.

3.3 INSTALLATION

A. General: Install all pipes in strict accordance with plans and with manufacturers' recommendations as approved by the Engineer.

B. Delivery, storage and handling of ductile-iron pipe and fittings shall follow the recommendations of AWWA and as specified herein.

C. Pressure pipe:
1. Pressure pipe shall be laid in accordance with plans and profiles and typical sections. Before new pipe is placed the subgrade material shall be graded so that pipe will rest firmly on undisturbed granular material for its full length.

2. In general, this should be accomplished by over-excavation, adding stabilization material as required, the inclusion of imported bedding material as shown on the plans. All adjustments to line and grade shall be made by scraping away or filling in the bedding to the body of the pipe and in no case by wedging a blocking. Pipe shall be laid on an unyielding foundation to proper line and grade with uniform bearing under the full length of the pipe with slight hand excavation for the coupling to allow for its thickness.
   a. Where soft or spongy conditions are encountered in the trench at pipe subgrade, this foundation situation shall be corrected by the use of imported stabilization material as specified in Section 31 20 00, “Earthwork”.
   b. All pipe, especially the ends, shall be carefully cleaned before the pipe is joined. Whenever Work ceases for any reason, the end of the pipe shall be closed with a watertight fitting, plug or cover. The interior of the pipe shall be kept free from dirt, foreign material or debris as the Work progresses and the pipe shall be cleaned after completion.
   c. Pressure line shall be laid to the line and grade shown on the plans. In instances where grade shows constant uphill grade to structures or air relief valve, the Contractor shall take all precautions necessary to secure continual smooth alignment to such appurtenances.
3. Joint deflection shall not exceed 50 percent of the manufacturer’s recommended maximum deflection. Fittings shall be provided as required to meet the line and grade indicated on the Contract Drawings.

D. Contractor shall notify Owner in advance per Division 1 requirements of need to shut down any water main and shall notify affected customers at least 7 days in advance if shutdown is to exceed 2 hours. Owner’s staff will perform water main shutoffs.

E. The Contractor is responsible for any and all measures required to remove trapped air from the lines, including making temporary taps as required. Some main segments will need to be installed at greater than the minimum cover to avoid creation of high points or to force the high point to the location of an appurtenance (service tap, etc.)

3.4 PROTECTION, BARRICADES, ETC.

A. Pipe strung out along the trench or stored where it can be damaged or where injury may result to children or the public shall have special precautions taken to prevent damage from occurring. Pipe shall not be spread along trenches for extended periods prior to its actual use. Pipe shall be stored in a safe location out of the

traveled way and properly barricaded with suitable lights provided to prevent vehicular damage.

3.5 LAYING BEDDING

A. All buried pipe shall be laid on a prepared bed as hereinbefore specified. After laying, additional bedding material shall be added to a depth of 3 inches or about the mid-point of the pipe depending upon diameter, after which it shall be tamped with a suitable tool to secure uniform full length bedding up to the mid-point of the pipe. Additional bedding material shall then be placed to the depth shown in the standard details of the plans and compacted by mechanical methods to a relative compaction of 90 percent.

B. Take necessary precautions to prevent uplift and floating of the pipe prior to backfilling.

C. Spigot end of the pipe shall be laid in the direction of normal flow away from the booster pumping system.

D. Water in trenches shall be removed by pumping.

3.6 CUTTING PIPE

A. General: Cut pipe for inserting valves, fittings, closure pieces, and as otherwise required, in a neat and workmanlike manner without damaging the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe.

B. Ductile iron pipe: Cut pipe with milling-type cutter, rolling pipe cutter, abrasive saw cutter, or with sledge and cold cutter. Do not flame cut.

C. Dressing cut ends:
1. Dress cut ends of pipe in accordance with the type of joint to be made.
2. Dress cut ends of mechanical joint pipe to remove sharp edges or projections that may damage the rubber gasket.

3.7 THRUST RESTRAINT

A. Provide fire protection pipe bends with concrete thrust blocks. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair. Provide minimum sq ft thrust restraint bearing on subsoil per Industry Standards.

B. Install thrust blocks at dead ends of fire water pipe

3.8 APPURTENANCES

A. General: See plans for location of valves and appurtenances to be installed as a portion of the water line.

B. Tape Wrap: Apply tape wrap per manufacturer’s recommendations.

3.9 TOLERANCES

A. Horizontal Line Tolerance: 2 inches.

B. Vertical Grade Tolerance: 1 inch. Any deviation with respect to design line and grade shall be recorded at least once per foot and the records shall be submitted to the Engineer as requested. If the alignment is off line or grade, the necessary corrections shall be made to return to the plan alignment at a rate of not more than 1 inch per 25 feet. All corrective work, including new design, if required, shall be performed by the Contractor at no additional cost to the Owner and is subject to the approval of the Engineer.

3.10 REPAIRS

A. Only new pipe free from defects shall be installed. Portions of broken pipe or short lengths may be used providing they are properly cut back and used as stubs, or short lengths required at structures for flexible joints.

B. Broken or leaking sections of pipe must be replaced. Repair clamps will not be approved.

3.11 PROTECTION OF FINISHED WORK

A. Section 01 17 00 - Execution Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.12 CLEANING

A. Care shall be taken to keep the pipe clean at all times during the installation. Prior to testing the pipe shall be flushed so that the velocities of 5 feet per second are obtained sufficient to clean the entire length of pipe.

B. If the Contractor digs out any sections subsequent to this where debris could enter the line, the line shall be again flushed through the section that was disturbed.

3.13 TESTING AND FINAL CLEANING

A. Testing and final cleaning of all pipes shall conform to the requirements of Section 33 13 00, "PRESSURE PIPING SYSTEMS TESTING".

3.14 DISINFECTION OF POTABLE WATER LINES

A. Conform to Section 22 11 16 “DOMESTIC WATER PIPING”.

END OF SECTION

SECTION 33 13 00

PRESSURE PIPING SYSTEMS TESTING

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design/Build Contractor.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 THE REQUIREMENT

A. The Contractor shall provide all materials, equipment, and labor necessary to perform and complete all pipeline deflection testing, pressure testing, and leakage testing for all pressure piping systems, as specified herein.

B. The Contractor shall be responsible for conveying test water from the source to the point of usage and also for proper disposal, as required, of water used in the testing operations. All costs associated with supply and disposal of test water shall be at the Contractor’s expense.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Division 1 General Requirements.

1.4 CONTRACTOR SUBMITTALS

A. A testing schedule, including proposed plans for conveyance, control and disposal of test water shall be submitted in writing to the Engineer for review a minimum of 72 hours before testing is to start.

B. The Contractor shall submit laboratory calibration certificates for all gages to the Engineer for review along with the testing schedule.

PART 2 - PRODUCTS

2.1 MATERIAL REQUIREMENTS

A. All testing equipment and materials shall be provided by the Contractor. No materials shall be used which would be injurious to pipeline system or structure and future function. All test gages shall be laboratory-calibrated test gages and shall be recalibrated by a certified laboratory at the Contractor's expense prior to the leakage test.

PART 3 - EXECUTION

3.1 GENERAL

A. All lines shall be cleaned and flushed prior to leakage testing and video inspection using methods acceptable to the Engineer.

B. Contractor will be solely responsible for the proper disposal of all water used in the flushing and testing process. Disposal of all water shall be in accordance with appropriate regulatory agency requirements.

C. All flushing and testing operations shall be performed in the presence of the Engineer.

D. All pipe shall be backfilled prior to leakage testing. All tests shall be completed and approved prior to placing of permanent surfacing. When leakage exceeds the amount allowed, the Contractor at its expense, shall locate the leaks and make the necessary repairs or replacements in accordance with the Specifications to reduce the leakage to the specified limits. Any individually detectable leaks shall be repaired, regardless of the results of the tests.

3.2 PRESSURE AND LEAKAGE TESTING OF PRESSURE PIPING SYSTEMS

A. General: All pressure piping systems shall be tested for pressure and leakage using a hydrostatic test.

B. Pressure Piping Hydrostatic Test: The Contractor shall furnish all materials, equipment and labor for making a hydrostatic test. Test equipment shall be approved by the Engineer.

1. Furnish the following equipment and materials for the tests:

AMOUNT	DESCRIPTION
2	Approved graduated containers
2	Approved pressure gauges
1	Hydraulic force pump approved by the Engineer
As Required	Suitable hoses and suction pipe

Gauges for testing shall be calibrated with a standardized test gauge provided by the Engineer at the start of each testing day. The calibration shall be witnessed by the Engineer.

2. Conduct the tests on buried pipe after the trench has been completely backfilled. The Contractor may, if field conditions permit, partially backfill the trench and leave the joints open for inspection and conduct an initial test. The acceptance test shall not, however, be conducted until all backfilling has been completed. Conduct the tests on exposed piping after the piping has been completely installed, including all supports and hangers.
3. Pressure Test: After the pipe has been laid and backfilled and final compaction has been obtained, the Contractor shall test pressure pipe between each valve section or pipe run. The pipe shall be slowly filled with water so that air is removed and the pipe shall be tested hydrostatically to a pressure of 200 psi for a minimum of one hour. Reaction blocking pipe restraints and the like shall be installed prior to test.
   All exposed pipe, fittings, valves and joints shall be examined during the test for seepage or other defects. Defects noted by this test shall be removed and replaced by the Contractor with sound material. Afterwards, the test shall be repeated to the satisfaction of the Engineer.
4. Leakage Test: A leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be two hours and during the test the main shall be subjected to a pressure of 100 psi. Leakage shall not exceed that as shown in Table 6A of AWWA Standard C600-93 or not in excess of 10 gallons per day per inch diameter per mile, whichever is less.
   If any test discloses leakage greater than specified, the Contractor shall at his own expense locate and repair the defective joints until the leakage is within the specified allowance.
5. The separate pressure and leakage tests described above for pressure pipe may be combined into one test by testing the pipe hydrostatically to a pressure of 200 psi for a minimum of two hours while completing all inspections and testing required above for seepage, defects and leakage.
6. Requirements for Exposed Pipelines: All exposed pipelines shall have no visible leakage during the specified test period. Any exposed pipeline with leakage shall be repaired or replaced.

3.3 FINAL CLEANING

A. Prior to final acceptance, all pipelines shall be flushed out and all accumulated construction debris and other foreign matter removed. Cleaning shall be done in a manner that will keep flushed debris from entering equipment and in a manner approved by the Owner.

B. Clean and disinfect domestic water pipelines in accordance with AWWA C651 and in accordance with Section 22 11 19, DOMESTIC WATER PIPING SPECIALTIES.

C. Clean fire-suppression water pipelines in accordance with Section 21 11 00, FIRE SUPPRESSION WATER-SERVICE PIPING.

END OF SECTION

SECTION 35 50 00

STEEL FLOAT

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design-Builder.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

This section provides the minimum requirements for the receipt, handling, inspections, and installation of the WETA Standard Float intended for use as the new ferry landing for the Vallejo Ferry Terminal Reconfiguration Project.

WETA is procuring the float under separate contract. Under the separate contract, a new float is being constructed based on the WETA Universal Charging Float, with modifications which are detailed in Attachment 3 of Volume 3, Technical Refereence Documents. The float is anticipated to be delivered, under the float procurement contract, to the Vallejo Ferry Terminal in August 2027.

Initial plans for the float are provided in the technical reference documents and WETA will provide additional progress plans throughout the duration of the float construction, including final As-Built Plans, as they are provided by the Float Supplier/Builder. The Design Builder shall be responsible for submitting all Requests for Information (RFI) required for their design to WETA, who will pass the RFI on to the Float Supplier/Builder. All communication regarding the new WETA Standard Float shall be directed through WETA.

Upon delivery of the WETA Standard Float to the Vallejo Ferry Terminal, the Design Builder shall conduct a thorough inspection of the float with WETA. Any discrepancies between the As-Built Plans and the condition of the WETA Standard Float shall be brought to the attention of WETA in writing. Upon completion of the inspection the Design Builder shall take full responsibility of the new WETA Standard float and shall be responsible for the handling, transport, inspections, maintenance, and installation of the float, and appurtenances.

1.3 REFERENCES

The latest edition of 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.

A. American Bureau of Shipping (ABS) Rules for Building and Classing Steel Vessels

B. American Welding Society (AWS) D1.1 Structural Welding Code – Steel

C. American National Standards Institute (ANSI) A14.3 Ladders - Fixed - Safety Requirements

D. AISC Steel Construction Manual, 15th ed., American Institute of Steel Construction.

E. SEI/ ASCE 7 Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers.

F. MIL-HDBK-1026/4A Mooring Design, Department of Defense Handbook.

G. American Society for Testing and Materials (ASTM)

1. A36 Standard Specification for Structural Steel
2. A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
4. A131 Structural Steel for Ships
5. A153 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware
6. A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
7. A240 Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
8. A276 Standard Specification for Stainless Steel Bars and Shapes
9. A307 Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
10. A479 Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
11. A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
12. A563 Specification for Carbon and Alloy Steel Nuts
13. A572 Standard Specification for High-Strength Low-Alloy Columbium Vanadium Structural Steel
14. A521 Standard Specification for Steel, Closed-Impression Die Forgings for General Industrial Use

15. A653 Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
16. A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
17. A959 Guide for Specifying Harmonized Standard Grade Compositions of Wrought Stainless Steels
18. A992 Specification for Structural Steel Shapes
19. F436 Specification for Hardened Steel Washers
20. F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs
21. F594 Standard Specification for Stainless Steel Nuts
22. F844 Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
23. F2016 Standard Practice for Establishing Shipbuilding Quality Requirements for Hull Structure, Outfitting, and Coatings
24. F3125 Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

1.4 WETA STANDARD FLOAT (MODIFIED UNIVERSAL CHARGING FLOAT)

A. Float Physical Characteristics:

1.	Overall Length	135'-0"
2.	Beam	42'-0"
3.	Molded Depth at Side of Float	6’-0”
4.	Molded Depth at Center Trunk	11'-9½" to 10’-1½”
5.	Center Trunk Freeboard	8’-7½” to 6’-11½”
6.	Lower Deck Freeboard	2’-10”
7.	Draft	3’-2” projection

B. Float Reference Documents:
1. Plans Entitled, "Water Emergency Transportation Authority Downtown SF Terminal Universal Charging Float Project – New Float,” (95% Submittal) prepared by Liftech Consultants Inc. and dated 10/15/2024.
2. Technical Specifications Entitled, “Universal Charging Float Procurement, RFP 24-007, Part B – Option Float Technical Specifications,” dated 4/3/2026, Revision 3.

C. Float Sequence of Work
   1. Coordination with WETA to take delivery of the new WETA Standard Float from the Float Supplier/Builder upon delivery to the Vallejo Ferry Terminal.
   2. Conduct a joint inspection by the Design Builder, the Port of San Francisco, and WETA of the condition of the new WETA Standard Float. Bring any discrepancies, defects, or other concerns to the attention of WETA via written and documented communication.
      a. The inspection shall consist of a full inspection of the entire float, including but not limited to the condition of the coating, condition of welds, condition of mooring fittings, condition of fendering elements and frames, etc. Submit a comprehensive report identifying all areas of coating failures on both interior and exterior of float, any other recommendations for repair/maintenance of the float and any noted discrepancies between the final As-Built Plans submitted by the Float Supplier/Builder and the condition of the float delivered to the Vallejo Ferry Terminal.
   3. Take possession of the new WETA Standard Float, assuming all responsibilities for the handling, transportation, installation, and care of the float.
   4. Proceed with setup of the new WETA Standard Float at the temporary landing location beginning with installation and removal of temporary electrical and data services at the Vallejo Ferry Terminal, in preparation of installation of the WETA Standard Float at the temporary landing location.
   5. The existing railing at the new temporary landing location will require modifications to allow for passenger access. Upon completion of modifications the Contractor shall install the WETA provided portable promenade railings and gates, furnishing any additional modifications as required.
   6. Installation of new temporary gangway pier, piling, and gangway hinge and plate.
   7. The WETA Standard Float will come furnished with shims at six (6) pile guides to allow the guides to accept 24” diameter piles.
   8. Contractor shall coordinate with WETA to retrieve the six (6) WETA-supplied 24” diameter × 80’ long temporary steel pipe piles from WETA possession at CS Marine Constructor’s Inc. yard at Mare Island Berth 19 in Vallejo, CA.
   9. Required pile driving of the six (6) WETA-supplied piles to secure the WETA Standard Float at the temporary landing location.
   10. Installation of new 10’x90’ gangway at the temporary gangway pier.
   11. Complete installation of the temporary portal and gate assembly, railing structures, transfer spans, plates, et cetera to complete the shore to temporary gangway to temporary float connections.
   12. Utilities including, but not limited to clipper readers, temporary electrical, and data lines, shall be installed at the temporary location in accordance with and the Project Plans and Specifications.
   13. Coordinate with WETA for inspection of WETA Standard Float at the temporary landing location readiness to be placed into service and transfer ferry operations to the temporary location. Obtain WETA authorization to begin Work on removal of permanent boarding facility before dismantling.
   14. After WETA approval of temporary boarding facility, disconnect and cap all existing utility lines between existing permanent boarding gangway and float.
   15. Upon completion the installation of the new approach way structures, the WETA Standard Float shall be removed from the temporary location to the new permanent float location.
   16. Transport and relocation of the six (6) WETA-supplied temporary steel piles to WETA’s possession at CS Marine Constructor’s Inc. yard at Mare Island Berth 19 in Vallejo, CA. Pile guide shims shall be removed and provided to WETA.
   17. Install all new utilities in accordance with the Project Plans and Specifications.
   18. Prior to commencement of ferry landings at the new location for the WETA Standard Float, conduct a joint inspection by the Contractor and WETA to obtain approval of

the WETA Standard Float. Test landings shall be conducted as part of these inspections.

1.5 CERTIFICATION

WETA is requiring the following certifications from the Float Supplier/Builder:

A. The float need not possess American Bureau of Shipping (ABS) classification. However, the following shall be submitted to the WETA's Representative:

1. A report of condition survey similar to that required for ABS Special Periodical Survey No. 3.

2. A certification from a qualified marine surveyor and/ or naval architect that the float is “fit for service intended” shall be submitted.

1.6 SUBMITTALS

The following submittals will be provided to WETA by the Float Supplier/Builder and may be made available, upon request by the Design-Builder to WETA:

A. Float Construction and Outfitting

1. Float Handling and Transportation Plan

2. Dry Docking Facility Qualifications

3. Shop Drawings and Specifications:

a. Submit electronically (CAD and pdf formats) Final Design Drawings and Specifications sealed by a Professional Engineer holding a valid Certificate of Registration in the state of California for modifications to the float pile guides, showing all materials, member shapes and sizes, dimensions, quantities, connecting details, and accessories.

b. Shop Drawings shall be provided for the float pile guide modifications and any and all additional specially fabricated items, and catalog sheets for all standard manufactured items that are to be incorporated into the float.

4. Float Design Calculations:

a. Submit electronically a pdf of Final Design Calculations for the float and all appurtenances attesting that the float conforms to all design requirements.

b. The calculations shall be complete, have a table of contents with page numbers, shall include design criteria, and shall be easily readable. Details of analysis work shall be provided and summarized. Computer program results shall be described and where program results are included the data shall be clearly described.

c. Calculations shall be prepared under the supervision of and sealed by a Professional Engineer holding a valid Certificate of Registration in the State of California.

d. Certification Test Reports: Submit certification from marine surveyor and/or naval architect attesting that the float conforms to the contract requirements.

5. As-Built Drawings:

a. Submit as-built versions of all drawings after final installation and acceptance of the equipment by WETA's Representative.

1.7 QUALITY ASSURANCE

The following quality assurance measures are in place for the Float Supplier/Builder:

A. Dry Dock Facility Qualifications:

1. The Dry Docking Facility shall have a minimum of five years successful experience in the dry docking of similar steel floats.

2. The Dry Docking Facility shall submit a minimum of three (3) similar project designs with its bid along with contact information for the operating authority or WETA.

B. Fabricator Qualifications for Float Maintenance and Modifications:

1. The Fabricator shall have a minimum of five years successful experience in the maintenance of similar steel floats.

2. The Fabricator shall submit a minimum of three (3) similar project designs with its bid along with contact information for the operating authority or WETA.

C. Inspections:

1. The fabricators facilities shall be available to WETA's Representative for inspection before and after award of contract.

2. Special Inspections and testing will be provided by WETA for fabrication and assembly.

3. The schedule is to be updated weekly once maintenance/modifications start.

D. Commissioning

1. The Contractor shall provide a commissioning checklist for review prior to commissioning the float system. The checklist shall include testing the operation of all components and systems for the entire range of operations, e.g., range of motion of the platform lift system, manual operation of the lift system, gates, doors, temporary ladders.

2. The Contractor shall invite the Engineer and WETA to participate in or observe the commissioning.

3. The Contractor shall submit documentation of the commissioning results for WETA's Representative review and acceptance.

1.8 DELIVERY

A. The project site is located at 289 Mare Island Way, on the east shore of the Mare Island Strait in Vallejo, CA.

B. Water access to the site is via San Francisco Bay and Mare Island Strait.

C. Landside access is via Mare Island Way in Vallejo, CA.

D. Fabricator shall obtain any and all necessary permits required for deliveries and shall coordinate all delivery activities with the site Contractor and WETA.

E. Design-Builder shall coordination with WETA to take delivery of the new WETA Standard Float from the Float Supplier/Builder upon delivery to the Vallejo Ferry Terminal.

F. Conduct a joint inspection by the Design-Builder, the Port of San Francisco, and WETA of the condition of the new WETA Standard Float. Bring any discrepancies, defects, or other concerns to the attention of WETA via written and documented communication.

G. The Float Supplier/Builder will not be responsible for the installation of any utilities on the float. The Design-Builder shall install utilities including but not limited to all float lighting, electrical service, sewer, fire, and water services. These utilities shall be designed to connect properly and aesthetically to the primary services from the gangway.

PART 2 - PRODUCTS

Items 2.1A through 2.1M below are to be furnished by the Float Supplier/Builder as part of the float procurement scope and are provided for reference only. Items 2.2A through 2.2D are within the scope of the Design Builder's work.

2.1 FLOAT PROCUREMENT SCOPE

A. STRUCTURAL STEEL

1. See Float Reference Documents and Section 05 12 00 – STRUCTURAL STEEL FRAMING

B. GALVANIZED BOLTS, NUTS, AND WASHERS

1. See Float Reference Documents and Section 05 12 00 – STRUCTURAL STEEL FRAMING

C. STRUCTURAL WELDING

1. See Float Reference Documents and Section 05 12 00 – STRUCTURAL STEEL FRAMING

D. MOORING HARDWARE

1. See Float Reference Documents.

E. RUBBER FENDER UNITS

1. See Float Reference Documents.

F. FLOAT PLATFORMS, RAMPS AND ADJUSTABLE RAMP SYSTEM

1. See Float Reference Documents.

G. NEOPRENE WASHERS AND GASKETS.

1. Neoprene washers and gaskets shall be Durometer 40.

H. NON-SKID SURFACE

1. See Float Reference Documents.

I. RING BUOYS

1. See Float Reference Documents.

J. PILE COLLARS

1. The pile collars shall be modified from their existing locations to match the arrangement of the WETA Universal Charging Float as shown on the plans.

K. ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE (UHMW)

1. Ultra-Fend manufactured by Ultra Poly or approved equivalent.

2. UHMW shall be all virgin material and white in color.

L. HATCHES, HATCH COVERS, AND FASTENERS

1. Hatches shall be removed as part of the Contractor’s inspection.

2. Upon completion of the inspection, the watertight voids shall be cleaned and dried out.

3. Hatches shall be reinstalled with new gaskets.

4. Hatch hardware shall be replaced in-kind.

M. CATHODIC PROTECTION

1. Existing anodes shall be removed and new zinc anodes shall be provided for the protection of the underwater hull area from corrosion.

2. One type ZHC-23 zinc anode conforming to Military Specification MIL-A-18001 with galvanized steel straps shall be provided for each 100 square feet of wetted surface area.

3. The anodes shall be installed on the underside of the keel plating and on the below-water portions of the two sides and two ends of the float by bolting the anodes to mountings welded to the steel hull.

2.2 VALLEJO FERRY TERMINAL SCOPE

A. LIGHTING

1. Lighting is to be incorporated into the float as shown on the architectural and electrical drawings, including safety lighting, navigational lights, deck lighting and egress lighting on passenger ramps/landings. See Electrical Specifications.

B. ELECTRIC LIFT

1. See Float Reference Documents.

2. Each of the three (3) adjustable ramps shall be raised and lowered using a new electric lift mechanism. New electric lift mechanism shall be manufactured by Bulldog or approved equal. Lift mechanisms will be furnished by the Float Supplier/Builder and powered by the Design-Builder.

3. In the event of a power outage, there shall be provisions for manually raising and lowering the ramps.

4. Ramp operation will be initiated by a “call button” located next to the specific ramp. This will energize the selected ramp and start the selected lift mechanism. The mechanism will be operational for a pre-set period of time. During this time, the ramp can be operated using a lever located adjacent to its outboard edge allowing the operator to accurately position the ramp. After the time is expired, the mechanism will shut down and return to its neutral position allowing another ramp to be selected for operation.

C. FIRE EXTINGUISHER

1. Provide new fire extinguishers as approved by the City of Vallejo Fire Marshall and as shown on the drawings.

D. BALLAST

1. The float shall be de-ballasted prior to transport.

2. Upon delivery of the float to the Vallejo Ferry Terminal, the float shall be re-ballasted by the Design-Builder in accordance with the float specifications provided by the Float Supplier/Builder.

3. Ballast water for float leveling shall be potable prior to the addition of anti-corrosion substances. A non-toxic corrosion preventive admixture shall be used with the ballast water. A means of inspection to monitor each compartment of the float for leak detection shall be provided.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pile guide collar assemblies shall be modified so that the required tolerances and alignment with respect to the guide pile are obtained as shown on the drawings.

B. Structural steel installation shall conform to the requirements of AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

C. Fasteners protruding above the surface of the deck shall have a low, rounded profile.

3.2 FLOAT APPURTENANCES

All float appurtenances, including but not limited to items shown on RFP Drawings, shall be coordinated with utilities and installed in accordance with the drawings (or as directed by the WETA) and the manufacturer's recommended method of installation.

3.3 FINISHING

A. The float hull and interior plating shall be painted as specified in Specifications Section 09 97 13 – STEEL COATINGS.

B. Walking surfaces, including toe and hinged end plates, shall have a non-skid finish as specified in Specification Section 09 97 13 – STEELCOATINGS.

C. Unless otherwise noted, all exposed carbon steel elements shall be galvanized and coated as described in Specifications Section 09 97 13 – STEEL COATINGS, except walking surfaces.

D. Galvanization and galvanization repair shall be performed as specified in Specification Section 09 97 13 – STEEL COATINGS.

3.4 TOLERANCES

A. After gangway is installed, the float is to be leveled by adding potable water to the ballast compartments. The float deck surface shall be leveled as follows:

a.	Heel	Not more than 1/2-inch, one side to other side
b.	Trim	Not more than 1 inch., one end to other end
c.	Freeboard	+/- 1/2 inch.

END OF SECTION

SECTION 35 59 13

DONUT MARINE FENDERS SYSTEMS

This specification section is provided to the Design-Builder for use in the final design. The criteria and performance detailed below represents the minimum content required for this specific specification section. Design-Builder shall submit the revised specification as part of the design submittals.

PART 1 - GENERAL

1.1 BRIDGING DOCUMENTS

A. These Bridging Documents provide information relating to the function, aesthetics, and quality of the Project which will be the basis for determining whether Design-Build Contract Documents comply with Project Design Criteria.

B. The details of construction technology and coordination of all aspects of the project, including code compliance, are the responsibility of the Design-Builder.

C. Refer to Division 0 and Division 1 for additional information on Design Build requirements, responsibilities and procedures.

1.2 DESCRIPTION

The work under this Section consists of design, fabrication, and installation of a steel pile with a floating donut style fender in accordance with the details shown on the contract drawings. The Contractor shall furnish all materials, labor, equipment, utilities, and incidental items necessary for the installation of donut marine fender systems as shown on the Construction Drawings and specified herein.

This specification pertains to the following:

- Donut fender piles protecting the ends of the ferry float

1.3 RELATED SECTIONS

A. Section 05 12 00 - STRUCTURAL STEEL FRAMING

B. Section 09 97 13 – STEEL COATINGS

C. Section 31 62 16 – STEEL PIPE PILES

1.4 REFERENCES

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

A. American Society for Testing and Materials (ASTM)

1.	ASTM A36	Specification for Carbon Structural Steel
2.	ASTM D256	Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
3.	ASTM D412	Test Methods for Rubber Properties in Tension
4.	ASTM D624	Test for Rubber Property Tear Resistance
5.	ASTM D638	Test Method for Tensile Properties of Plastics
6.	ASTM D785	Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
7.	ASTM D1052	Specification for Measuring Rubber Deterioration (Cut Growth Using Ross Flexing Apparatus)
8.	ASTM D1630	Specification for Rubber Property- Abrasion Resistance (NBS Abrader)
9.	ASTM D1894	Standard Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting
10.	ASTM D2240	Standard Test Method for Rubber Property- Durometer Hardness
11.	ASTM D3575	Test Methods for Flexible Cellular Materials Made From Olefin Polymers

1.5 SUBMITTALS

Submit the following in accordance with the General Provisions of these Specifications.

A. Manufacturer's Catalog Data: Include Manufacturer's product data for all fender elements, hardware, including bolts, anchor bolts, inserts, nuts, washers, chains, turnbuckles, dimensions, material specifications, working loads and ultimate loads, as applicable.

B. Test Fender Performance Reports: Submit reports for tests specified for fender and fender material performance.

1.6 DELIVERY, STORAGE, AND HANDLING

Fenders shall be undamaged when delivered and shall be handled and stored so as to prevent damage such as bending or abrading end fittings or cutting of rubber. Protect fenders from exposure to damaging liquids, oils, and greases

1.7 WARRANTY

Furnish the manufacturer's warranty. The warranty period shall be not less than 10 years from the date of acceptance of the work.

1.8 FENDER PERFORMANCE

A. Donut Fenders are placed strategically to protect the Ferry Barge. The donut fenders will be mounted to steel piles sized for the abnormal berthing energy reaction.

B. The fender shall also reflect the following characteristics:

1.	Type:	Foam-Filled Donut
2.	Minimum Energy Absorption:	6.3 kip-ft per foot
3.	Maximum Reaction Force:	15.7 kips per foot
4.	Donut Fender Diameter:	8.2 feet
5.	Minimum Contact Length:	5 feet minimum
6.	Pile Size:	36 in. diameter
7.	Fender Color:	Black

1.9 QUALIFICATIONS

The fender manufacturer and supplier must have a minimum of 20 years of experience in the supply of marine donut fenders. Documentation supporting this qualification shall be provided with the technical data submittal required for the fender.

PART 2 - PRODUCTS

2.1 FREE FLOATING, FOAM FILLED, DONUT MARINE FENDER.

A. Provide a MFI Ocean Guard Foam-Filled Donut Fender, 8.2-foot nominal diameter with minimum contact length of 5-feet for a 3 ft pile, Extra High Capacity (EHC) or approved equivalent.

2.2 CONFIGURATION

A. The fender shall be free floating with a cylindrical body (axis vertical).

B. The inner bearing surfaces between the fender and the pile shall permit the fender to rise and fall with the water level, and/or rotate around the pile without binding.

C. The bearing materials shall be fixed to, but removable from, the internal core.

D. When the Donut is centered on the pile, the clearance between the bearing surfaces and the pile shall be one inch maximum.

E. There shall be nothing on the core that would prevent deflection of the resilient foam layer to less than full deflection.

F. Lifting eyes shall be provided at each end, top and bottom, of the Donut.

G. An annular layer of resilient closed-cell foam shall be fixed to the internal core. This layer shall be continuous from the internal core surface to the outer skin of the fender.

H. The exterior surface of the fender (excluding steel parts) shall be a weather-resistant polyurethane elastomer, reinforced with multiple layers of continuous nylon filaments.

2.3 BEARING MATERIAL

A. Bearing material shall be of ultra-high molecular weight polyethylene (UHMWPE).

B. Bearing material shall be UV-stabilized and resistant to abrasion, oil, seawater, and weather.

C. Sufficient bearing material shall be used to distribute the reaction load over the pile evenly.

D. The material shall be at least 2 in. thick and distributed around the entire inside surface of the steel core.

E. The material shall have a wear surface of at least 1 inch.

2.4 RESILIENT FOAM

A. The resilient foam core shall be homogeneous and of one-piece fabricated construction and shall not be in chip or granular form.

B. The form core shall not contain scraps, strips, or sheets of foam either rolled or stuffed into the required shape unless pieces are bonded together in layers of uniform patterns to form a homogeneous, one-piece core.

C. Homogeneous foam rings of adequate thickness to insure performance of the fender are acceptable provided the Contractor can show a minimum 10-year performance of similar fenders.

D. Foam shall be resilient foam with closed-cell, cross-linked polyethylene as specified below, fabricated in a homogeneous form.

E. The foam core shall be of heat-laminated construction.

F. Use of chopped, granulated, or otherwise particulate foam is not acceptable.

2.5 FENDER SKIN

A. The elastomer skin of the fender shall be free from cracks, burrs, warpage, checks, chipped or blistered surfaces, and shall have a smooth surface.

B. The outer skin of the fender shall be constructed of polyurethane elastomer reinforced with continuous nylon filaments.

C. The elastomer skin (with wraps) shall extend along the entire longitudinal axis of the fender, over the ends of the resilient foam layer, and onto the rigid core, and shall completely enclose all the filament wraps.

D. The fender skin shall be bonded securely to the steel of the internal core.

E. Filament wraps shall be evenly distributed within the inner 75% to 90% of the skin thickness.

F. Color: Fender skin color shall be black throughout the entire thickness. Galvanized hardware shall be unpainted.

G. Reparability: The fender casing shall be repairable in the event of tears or punctures in the elastomer skin. Required repair materials shall be readily available from the fender manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

Install fenders as indicated on the Construction Drawings and in accordance with the manufacturer's recommendations.

END OF SECTION