BUREAU OF ENGINEERING
Special Provisions

Division 02 – Site Work
Division 03 – Concrete
Division 05 – Metals
Division 09 – Finishes

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AVON STREET (1923) BULKHEAD
W.O. E1909302

City of Los Angeles
California

Department of Public Works
Bureau of Engineering

SPECIAL PROVISIONS

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SECTION 02210
CLEARING, GRUBBING AND STRIPPING

PART ONE - GENERAL

1.1 DESCRIPTION

A. All site clearing and grubbing on the job-site indicated on the Contract Drawings.

B. Site clearing shall consist of removing all vegetable growth such as trees, roots, stumps, shrubs, brush, limbs; and stone, boulders, clods, wood and other vegetative growth from the growth surface. Clearing shall also include the removal and disposal of trash piles, rubbish, etc.

C. Grubbing shall consist of the removal and disposal of wood roots, stumps, shrubs, brush, stone, boulders, clods, vegetable growth, etc. below the ground or subgrade surface.

D. CONTRACTOR shall furnish all tools, equipment materials and supplies and shall perform all labor to complete the work associated with removal of all natural and artificial objectionable material from the designated areas of work as indicated in the Contract Documents.

E. This work shall also include the protection from injury and preservation of existing improvements, adjacent property, utility vegetation and existing objects designated to remain.

F. Prior to commencing the work, obtain acceptance from the ENGINEER regarding methods to be used and disposal of removed materials.

G. Related Sections:

1. Documents affecting work of this Section included, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, DIVISION 1 - GENERAL REQUIREMENTS and other Sections of the Project Manual.

2. Site Demolition in Section 02220.

3. Earthwork in Section 02310.

4. Concrete work in Section 03300.

1.2 QUALITY ASSURANCE

A. Labor: Use adequate numbers of skilled laborers thoroughly trained in site-clearing operations and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work of this Section.

B. Codes and Regulations: Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA, County and [1999] Los Angeles City Building Code and applicable Amendments. [Conform to all storm water pollution control measures as required and provided in Section 02310 - EARTHWORK of the Project Manual.] Provide additional measures, added materials and devices as may be needed as directed by the City Engineer or the Consultant at no added cost to the City.

C. Miscellaneous Requirements:

1. Erection and maintenance of protections

2. Dust Control

3. Repair of Damages

4. Cleaning and Removal of Rubbish

D. Permits and Licenses: Procure all City, County and State Permits and Licenses, including Municipal Business License and pay all charges and fees for the same.

E. Contractor Submittals - Submit schedule of clearing, grubbing, and erosion control measures to be put in place for all work scheduled during the rainy season (October - April).

PART TWO - PRODUCTS

2.1 MATERIALS

A. Provide Materials not specifically described but required for completion of the work of this Section as selected by the Contractor subject to the approval of the City Engineer or the Consultant.

PART THREE - EXECUTION

3.1 SITE CONDITIONS

Examine the job-site and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper site-clearing operations, as directed by the City Engineer or the Consultant. Do not proceed until such detrimental conditions have been corrected.

3.2 PROTECTION

A. Protect Existing Structures and Site Improvements indicated to remain from damage by approved methods and/or as authorized by the City Engineer. Removal of all protections shall be when work of this Section is completed or when so authorized by the City Engineer or the Consultant. Apply protections to adjacent properties as required and directed by the City Engineer.

B. Protect Existing Utilities [Indicated or made known to remain] traversing the job-site and serving existing adjacent facilities.

C. Protect Existing Trees and Shrubs [Indicated to remain] by providing temporary surrounding fencing so located a sufficient distance away so that trees and shrubs will not be damaged by site-clearing operations.

D. Protection of Persons and Property (existing structures and site improvements).

1. Provide barricades, warning signs at open depressions and holes on adjacent property and public accesses.

2. Provide operating warning lights during hours from dusk to dawn each day or as otherwise required.

3. Protect existing remaining structures, utilities, sidewalks, pavements other facilities from damage as caused by settlement, undermining, washout or other hazards created by site-clearing operations of this Section.

4. Provide and maintain pedestrian and vehicular access in accordance with Work Area Traffic Control Handbook (WATCH), latest edition.

E. Use means necessary to prevent air pollution or dust from becoming a nuisance to the public, to neighbors and to others performing work on or near the job-site. Comply with governing regulations.

F. Maintain access to the job-site, other neighboring property, street and alley at all times.

G. The project site shall be maintained in conformance with Section 7-8 - PROJECT SITE MAINTENANCE of the Standard Specifications for Public Works Construction (SSPWC) and the requirements of this Project Manual.

3.3 SITE CLEARING AND GRUBBING

A. General:

1. For drawing clarity, not all trees, shrubs, brush, grass, weeds, or exact amount of trash or debris are shown on the drawings. Contractor shall carefully study the Contract Drawings, the Geotechnical Data Report and the Survey (when provided as part of the Bid Documents), visit the job site and verify the extent of the work to be done prior to the Bid.

2. Prior to starting job-site clearing operations in the company of the City Engineer or Consultant Architect, Soil Engineer and Inspector; visit the job site and verify the extent of the work.

3. Site clearing and grubbing shall conform to Section 300-1 - CLEARING AND GRUBBING of SSPWC and applicable requirements of the Project Manual.

4. Site clearing and grubbing shall be done in the presence of the Soil Engineer. Contractor shall notify the City Engineer 72 hours prior to clearing operation.

B. Site Clearing and Grubbing Operations

1. Clean out all vegetable growth, roots, stomps, clods and other objective materials to a depth of the finish grade.

2. Remove all concrete and masonry debris. Remove stones, boulders, clods which are two (2) inches or larger. Remove stones, boulders, clods which are one (1) inch or larger from all utility trenches.

3. Remove all existing rubbish and debris or those resulting from work operations of this Section as soon as possible, do not allow to pile up. Do not burn rubbish and debris on the job-site.

4. Where active utility lines need to be capped or plugged, perform such work in accordance with requirements of the Utility Company or government agency having jurisdiction and conform to provisions of Section 01140 - CONTRACTOR□S USE OF THE PREMISES, and Subsection 3.2B of this Section.

5. Existing Services to remaining structures are to be maintained at all times.

3.4 STRIPPING

A. Stripping shall include the removal and disposal of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. The depth of stripping shall be as shown on the Drawings and specified herein.

B. Topsoil from the strippings shall be stockpiled and used for the finished site grading. Excess topsoil will be placed in the waste disposal areas designated by the ENGINEER.

C. Prior to beginning any excavation or fill, strip the topsoil and stockpile for re-use, where landscaping is applicable. In general, topsoil shall be removed where structures are to be built, trenches dug, and roads, parking lots, walks, and similar improvements constructed within the areas presently covered with topsoil. Topsoil shall be stored clear of the construction area. Take reasonable care to prevent the topsoil from becoming mixed with subsoil.

3.6 REMOVAL AND DISPOSAL OF CLEARING AND GRUBBING DEBRIS

A. General: All materials removed shall be disposed of outside of the right-of-way. No accumulation of flammable material shall remain on or adjacent to the right-of-way. The roadway and adjacent areas shall be left with a neat and finished appearance.

B. Bituminous Pavement: Bituminous pavement removal shall be in conformance with SSPWC Section 300-1.3.2.

C. Concrete Pavement: Concrete pavement removal shall be in conformance with SSPWC Section 300-1.3.2.

D. Concrete Curb, Walk, Gutters, Cross Gutters, Driveways, and Alley Intersections: Concrete removal shall be in conformance with SSPWC Section 300-1.3.2.

3.7 STORAGE OF MATERIALS AT THE JOB-SITE

Storage not permitted beyond brief accumulation awaiting pick up by removal trucks. Delays in the removal of site-clearing materials from the job-site shall be subject to the approval of the City Engineer or the Consultant.

(END OF SECTION)

SECTION 02220
SITE DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section covers all wrecking and demolition, together with the removal and disposal of items.

B. Related Work Specified Elsewhere:
1. Refer to Division 0, GENERAL CONDITIONS and Division 1, GENERAL REQUIREMENTS.
2. Clearing and grubbing is specified in Section 02210, CLEARING AND GRUBBING.
3. Excavating and filling for the site is specified in Section 02310, EARTHWORK, except as herein specified.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
1. Traffic:
a. Do not close, obstruct, or store material or equipment in streets, sidewalks, alleys or passageways without a permit in accordance with all local ordinances, regulations and codes.

1.03 JOB CONDITIONS

A. Remove material called for on the plans, and store as directed, the items to remain the property of the Owner. These items are assumed to be in good operating condition at the time the Contract is signed. Properly protect them and remove them complete, including all appurtenances, and deliver in good order to the Owner as directed.

B. Environmental Requirements:

1. Ground and Surface Water. After the existing buildings or structures have been removed, protect the resulting building excavation or open area from surface or ground water. Promptly remove any water which accumulates in the excavation or opening. The method of dewatering and the disposal of the water is subject to review by the (Owner) (Geotechnical Engineer) (Architect).

C. Protection:

NOTE: Delete parts that do not apply.

1. General Requirements. Protect persons and property in accordance with the GENERAL CONDITIONS. Remove all temporary construction upon completion of the Project.
a. Temporary protective fence. Before beginning any excavation or construction Work at the site, erect a temporary protective fence around the excavation and immediately adjacent to the building. Erect a 4 foot (1.22 m) high fluorescent orange temporary protective fence secured to posts not more than 8 feet (2.44 m) o.c.

2. Existing structures and property. Take precautions to guard against movement or settlement of adjacent buildings or structures. Provide and place bracing or shoring as necessary or proper in connection therewith. Be responsible for safety and support of such buildings and structures. Be liable for any movement or settlement, any damage or injury caused thereby or resulting therefrom. If at any time safety of any adjacent buildings or structures appears to be endangered, cease operation, take precautions to support such buildings or structures and notify the Architect. Resume operations only after permission has been granted. If the Architect considers additional bracing or shoring necessary to safeguard, or prevent movement or settlement, install such bracing or shoring upon Architect's order. If the Contractor fails to comply promptly with such order, such bracing and shoring may be placed by the Owner at the Contractor's expense.

PART 2 (NOT USED)

PART 3 EXECUTION

3.01 INSPECTION

A. Condition of Premises:
1. Accept the premises as found and clear the site as specified. The Owner assumes no responsibility for condition of buildings on site at time of proposal or continuation of conditions thereafter. Assume risk regarding damage or loss, whether by reason of fire, theft, or other casualty or happening to specified buildings.

3.02 PREPARATION

A. Utilities:
1. Prior to disconnecting, removing, plugging or abandoning existing utilities serving the buildings being removed, notify all utility corporations, companies, individuals or local authorities concerned with the Work.

3.03 INSTALLATION/APPLICATION/PERFORMANCE/ERECTION

A. Performance:
1. Wrecking and Demolition.

a. Buildings and Other Items. Wreck, demolish, dismantle and completely remove all buildings, items, and obstructions as shown on the drawings or called out in these specifications. Remove any existing rubbish, trash and junk and leave the site clear of such materials. Remove all foundations completely. Remove all basement and cellar floors and other concrete slabs.
(1) Dust Retention. In demolishing masonry walls, etc., keep work wet down thoroughly to prevent dust and dirt from rising. Provide necessary water, waterlines and connections for this purpose.
(2) Pneumatic Tools. Work with pneumatic or vibratory tools will generally be permitted, however on certain areas the Architect may direct that only hand tools be used.
b. Walks and Drives. Where indicated on the drawings, remove pavement, curbs and sidewalks to full depth, take care to avoid damage to adjacent

remaining pavement or sidewalks. Make cuts in such a manner that a clean vertical joint remains.

c. Utilities. Disconnect electrical service and/or cut off and cap gas, water and sewer services at the mains on the property or in the street as required by the responsible utility company, or local authority or relocate as shown on the drawings. Remove and cut off and plug or cap all utilities within the existing building areas, except those designated to remain. The Contractor shall coordinate the removal Work with the relocation and/or new Work being performed by all contractors.

d. Removal. Unless otherwise noted or specified to be relocated or stored, all materials removed become the property of the Contractor and are to be removed completely away from the site by him. Do not store or permit debris to accumulate on the Site. If the Contractor fails to remove excess debris promptly, the Owner reserves the right to cause same to be removed at Contractor's expense.

3.04 FIELD QUALITY CONTROL

A. Workmanship:

1. Demolition Work. Execute in an orderly and careful manner with due consideration for neighbors and the public. Execute the Work to insure adjacent properties and the public against damages incurred by falling debris or other causes.
2. Masonry. Demolish in small sections and brace and shore where necessary to avoid collapse of the structure.
3. Burning of Materials. Burn no materials or debris on the premises.
4. Dust control. Constantly sprinkle all rubbish and debris to lay down the dust.

B. Traffic:

1. Interference. Conduct operations with minimum interference with roads, streets, driveways, alleys, sidewalks and other facilities.

3.05 ADJUSTMENT AND CLEANING

A. Temporary Structures. Remove all temporary structures when they are no longer required.

B. Repair:

1. Clean up, repair, or replace at no cost to the Owner, all property damaged by reason of required Work, including restoring all disturbed areas, surfaced and unsurfaced, to their original condition on completion of the Work. All patchwork shall match existing and be performed in a neat and workmanlike manner by craftsmen skilled in the trade involved. Painted surfaces shall be painted to match the adjacent areas. In newly graded areas take every precaution and temporary measures necessary, such as temporary seeding, to prevent damage from erosion of freshly graded areas. Where any settlement or washing may occur prior to acceptance of the work, repair and re-establish grades to the required elevations and slopes at no additional cost to the Owner. This applies to damage to the newly graded areas within the construction limits and damage to adjacent properties by eroded material.

END OF SECTION

SECTION 02240
SHEETING, SHORING AND BRACING SYSTEMS

PART 1 -- GENERAL

1.1 SUMMARY

Provide shoring at open excavations and elsewhere where greater than 5-feet in depth. Shoring shall be furnished, placed, maintained and removed by the Contractor, as needed to protect workers, materials, other properties and the public.

1.2 SYSTEM DESCRIPTION

A. General:

1. Shoring systems are not fully detailed on the Drawings, which are diagrammatic and show design intent of finished profiles, shapes and forms

2. Specifications are of the performance type and include the minimum requirements of the excavation support system without limiting the Contractor to methods of achieving such performance.

B. Survey of existing conditions:

1. Employ California licensed surveyor or civil engineer to make a survey of existing adjacent structures and improvements.

   a. Establish precise elevations at fixed points to act as benchmarks.

   b. Clearly identify benchmarks and record existing elevations.

2. Photograph conditions encountered to highlight defects in existing construction. Notify the Engineer and registered owners of adjacent properties in writing when the survey is to be made and photographs taken so they may have representatives present.

   a. Have those representatives present sign the survey and photographs as witnesses.
   b. Upon completion of this work, make a similar examination of the properties originally surveyed, giving similar notice to all interested parties so they may be present during the final examination of the properties. Send a record of the original and final examinations to all concerned parties.

C. Design Requirements:

1. Shoring: Design shoring in accordance with all applicable codes, and in accordance with the specific requirements specified in the Geotechnical Data Report. All wood components of the shoring system shall be constructed of pressure treated wood in conformance with the code requirement.

2. Loading: Design and construct shoring to withstand all soil and hydrostatic loading that might occur during the various stages of construction and for any surcharging loading caused by equipment loads, loads from material or soil stockpiles, and earthquake-induced loads.

a. Determine the soil, surcharge, and hydrostatic loading, but in no case shall the loading be less than the earth and minimum equipment surcharge pressures.

b. Determine the proper load distributions caused by such activities and assure that those conditions are not exceeded in the field during construction.

c. Design the shoring for lateral earth and water pressures and surcharge loads that could result from construction methods and dewatering activities.

d. Consider the intermediate stages during sequence of excavation and backfilling, including placement and removal of the lateral support elements, in the shoring design.

2. Allowable deflection: Refer to paragraph 3.4B of this Specification Section.

3. Existing pipes or structures shall not be used to support any portion of the open excavation unless approved by the Engineer in writing.

5 The design of shoring shall conform to accepted engineering practice in this field. Approval of the Contractor's plans and methods of construction by the Engineer or the authorized agencies does not relieve the Contractor of his responsibility for the adequacy of the shoring system.

D. Performance Criteria

1. The Contractor shall be solely responsible for and bear the sole burden of cost for any and all damages resulting from improper shoring or failure to shore.

2. The safety of workmen, the protection of adjacent structures, property and utilities, and the installation of adequate supports for all excavations shall be the sole responsibility of the Contractor.

3. The design, planning, installation, and removal of all shoring shall be accomplished in such a manner as to maintain stability of the required excavation, or trench section, and to prevent any movement of soil that may cause damage to adjacent structures and utilities, damage or delay the work, or endanger life and health.

1.3 RELATED WORK SPECIFIED ELSEWHERE

Section [02310] Earthwork

B. Section [02810] Irrigation System

C. Section [03300] Cast-in-Place Concrete

D. Section [05120] Structural Steel

E. Section [07290] Waterproofing

F. Section [14200] New Traction [Serving] [Passenger] [Elevator]

F. Section [14241] Hydraulic Passenger Elevator

G. Division [15] Mechanical

H. Division [16] Electrical

1.4 CONTRACTOR SUBMITTALS

A. Comply with pertinent provisions of Section 01330 - SUBMITTALS of DIVISION 1 - GENERAL REQUIREMENTS.

B. Design and Calculations: The Contractor shall design and prepare shoring drawings and make calculations of materials used structurally in excavations, footings and foundation in accordance with the code requirements.

C. Shop Drawings: After submitting drawings for shoring to the Engineer for review, the Contractor shall incorporate all comments or corrections in the drawings, and submit to the authorized governing agencies for approval, at least three (3) weeks prior to commencement of work. After the approval is obtained, the Contractor shall submit seven (7) duplicate copies of the approved drawings to the Engineer. No excavations shall start until all the reviews and approval of the shoring design, which includes the following minimum items, have been obtained from the authorized agencies, or the Engineer:

1. Design assumptions, analysis calculations, and information on Contractor's proposed method of installation and removal of all shoring.

2. The maximum design load to be carried by the various members of the support system.

3. Detailed excavation support drawings, showing all pertinent dimensions, spacing, and relationships among the components of the shoring, as well as construction sequence and scheduling. Drawings shall show adjacent existing improvements including utilities within a lateral distance equal to the depth of excavation.

4. The method of bracing and preloading, if any.

5. Detailed utility and structure support drawings, where necessary.

6. The full excavation depth and depth(s) below the main excavation to which the support system will be installed.

7. Detailed sequence of construction and loads for various stages of bracing installation and removal.

8. Detailed drawings and descriptions of the method to be used by the Contractor to monitor shoring movements.

9. Types of construction equipment intended to be used in this Project.

10. Method of removing the soil from the trench or excavation.

11. Backfill materials and method of backfill and compaction.

12. Dewatering Plans.

D. Quality Control Submittals:

1. Design Data: All the design and calculations and shop drawings shall be sealed and signed by a Civil or Structural Engineer licensed in the State of California and experienced in the design of earth retaining structures. The professional engineer shall be obtained and paid for by the Contractor.

E. Permits:

1. Submit in accordance with provisions in Section 01112 – DESCRIPTION OF WORK in DIVISION 1 - GENERAL REQUIREMENTS and other Sections of the Project Manual.

2. The Contractor shall submit shoring drawings and calculations to the Los Angeles City Department of Building and Safety and obtain and pay for the required permit(s).

3. Obtain permit(s) as required by Title 8, Division 1-DEPT. OF INDUSTRIAL RELATIONS, Chapter 4 –DIVISION OF INDUSTRIAL SAFETY of the California Code Of Regulation, and pursuant to Subsection 7-10.4.1 - SAFETY ORDERS of SSPWC, prior to excavating to the depth of 5-feet or greater. A duplicate copy of the permit shall be submitted to the Engineer for review prior to the start of excavation.

F. Certification Form: Contractor shall completely fill out a Competent Person Trench/Excavation Certification Form provided by Inspector of Bureau of Contract Administration prior to any worker access to trench or excavations, and return it to the Inspector. Contractor shall certify by this form: the name of the competent person administering the work, the soil classification, and the type of excavation protective system provided/installed.

G. Shoring Monitoring Data: As Specified herein.

H. Notification: As required by Section 3307 of the Los Angeles City Building Code, before commencing any excavation of greater depth than the walls or foundation of any adjoining building or structure and located closer to the property line and the depth of excavation, the Contractor shall provide a 30-day written notification by certified mail, return receipt requested, to the adjacent property owner of the intent to excavate, including the depth of excavation, and when the excavation will commence. Evidence of such notification shall be provided to the Department of Building and Safety for issuance of an excavation permit. Adjoining buildings should be protected

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the

specified requirements and the methods needed for proper performance of the work of this Section.

B. Employ a qualified engineer having at least five (5) year experience to design the shoring system and to inspect and report on the quality of its construction.

C. Comply with pertinent requirements of governmental agencies having jurisdiction.

D. Coordinate the shoring design and construction with:

1. Geotechnical Data Report prepared for this Work;

2. Structural system established for the Work, including location of columns, pilasters, walls, and other features.

3. Utilities established in the site.

E. Regulatory Requirements:

1. Conform to provisions of Section 01410 - REGULATORY REQUIREMENTS in the GENERAL REQUIREMENTS.

2. Comply with applicable requirements, but not necessarily limited to, shown on the Contract Drawings; latest adopted version of the Los Angeles City Building Code, Section 1802 – QUALITY AND DESIGN and Section 3301 – EXCAVATION AND FILLS; State of California, Code of Regulations, Title 8 – INDUSTRIAL RELATIONS, Division 1-DEPARTMENT OF INDUSTRIAL RELATIONS, Chapter 4 – DIVISION OF INDUSTRIAL SAFETY, Subchapter 4 – CONSTRUCTION SAFETY ORDERS, Section 1539, 1540, and 1541.

1.6 PROTECTIONS

A. Protect adjacent existing improvements against damage by the Contractor's operations. Protect all excavation so that the soil of adjoining property will not cave in or settle. Repair or replace damaged items to the full satisfaction of the Engineer at no extra cost to the City.

B. Shore, crib or lag excavations and earthbanks, as necessary, to prevent caving in, erosion or gullying of sides.

C. Divert or pump water out of all excavations and trenches until all installation work and backfilling are completed and inspected.

1.7 INSPECTIONS

A. Excavation of existing fills, reworking of natural soils and compaction of all required fills will be inspected and tested by the City of Los Angeles Building and Safety Inspector and the Geotechnical Engineer of Record.

B. Place all such backfill under the full supervision of the Geotechnical Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until detrimental conditions are corrected.

B. Existing Utilities: Contract Drawings show major utilities, but all utilities may not be shown. The Contractor will obtain all as-built records of existing utilities from local government authorities or Utility Companies and field check locations of utilities with representatives of the Utility Company. Protect from damage and provide utility trench support to any sewer, storm drain, water, gas, electric or other pipelines or conduits uncovered during work.

1. Excavate by hand or other excavation methods acceptable to the utility owner.

2. If existing utilities interfere with Contractor's proposed method of support, any required modification to the shoring system or relocation of interfering utilities shall be performed at no additional cost to the City.

4. Contact Underground Service Alert, (800) 422-4133, and obtain underground service alert inquiry I.D. Number 48 hours prior to digging. Report the I.D. Number to the Bureau of Contract Administration when calling for inspection.

C. Provisions for Contingencies:

1. Provide a contingency plan or alternative procedures to be implemented, if unfavorable performance is evidenced from the shoring monitoring program.

a. Keep on hand the necessary materials and equipment to implement the contingency plan.

2. If support elements project beyond the vertical projection of the right-of-way shown on the Contract Drawings onto adjoining property, the Contractor shall obtain permission of the adjoining property owner in writing. The Contractor shall bear cost required to obtain such permission.

3. Subsurface Conditions: Evaluate subsurface conditions as excavation occurs.

4. Differing Conditions: Notify the Engineer of differing conditions that could affect the shoring design assumptions.

5. Acceptance: Proceeding with work means acceptance of existing conditions.

6. Notifications: The Contractor shall make all the necessary notifications to the adjacent properties, as described herein before.

3.2 PREPARATION

A. Protection:

1. Protect or repair utilities damaged by operations of this Section.

2. Protect adjacent structures and property from damage and disfiguration.

B. Dewatering:

1. Where applicable, no excavation shall commence until the Contractor has demonstrated to the satisfaction of the Engineer that the groundwater level has been lowered to the required level and that the soils inside the excavation are in the dewatered condition that was assumed in the Contractor's shoring design and submittal.

3.3 INSTALLATION

A. All trench and excavation openings shall be lighted and fenced or barricaded during nights, weekends, and other times, as necessary, and meet CAL/OSHA safety requirements.

B. All shoring shall be installed to the lines and elevations shown on the Contractor's approved Construction Drawings. No component of the shoring system shall infringe on the minimum dimensions of any permanent structure shown in the Construction Drawings.

C. The excavation shall be staged as shown in the Construction Drawings or on required work documents and in such a manner as to provide a stable system of support at all times.

D. Should the shoring system utilize steel H-beams, piles, or other similar vertical supports, driving of said vertical supports will not be permitted in proximity of existing structures or sensitive utilities, except for the last 4-feet. The vertical supports shall be placed in holes drilled to a depth of 4-feet above the proposed bottom of the pile, except where this procedure is impracticable. The vertical support may then be driven to the required depth, not to exceed 4-feet. During the drilling and driving operations, the Contractor shall take care to avoid damage to utilities.

At locations where the drilling of such holes is impracticable despite reasonable mitigation methods because of the existence of obstructions or rocks, running sand, or other adverse condition, and provided said impracticability is demonstrated to the satisfaction of the Engineer by actual drilling operations by the Contractor, the Engineer may, upon request of the Contractor, approve the use of means other than drilling for the purpose of placing the vertical support. Such other means, however, must be of a nature which will accomplish, as nearly as possible, the purpose of the drilling, namely, the prevention of damage to existing surface or subsurface improvements, both public and private.

3.4 MONITORING

A. Employ a California-licensed surveyor or civil engineer to design, construct and maintain an on-going monitoring system of the horizontal and vertical deflections

of the excavation support systems and the settlement of the adjacent ground and structures.

1. Regularly resurvey benchmarks specified during installation of excavation support systems.

2. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open.

3. Regularly survey adjacent ground and structures to verify that no settlement is occurring or has occurred as a result of the construction activities.

4. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Maintain accuracy within 1/100 of a foot and keep records in a readily understandable form, such as a tabular form of both the net and total deflections (both horizontal and vertical) of each soldier pile.

B. Submit a copy of all the daily readings to the Engineer at the end of each week. Notify the Inspector or the Engineer immediately for any excessive movements or deflection.

1. If changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction, promptly notify Engineer and immediately take steps to remedy the situation.

2. Horizontal and lateral deflections into the excavation at any location on the shoring shall be limited to a maximum of 1 inch, or to a maximum of 0.5 inch within the influence zone of an existing structure, adjacent to a utility sensitive to deflection, or other special circumstances as determined by the Engineer for work in or affecting the public right-of-way. Deflection in private property not affecting the public right-of-way shall be limited to 0.5 inch.

3. The total of the allowable calculated deflection for secondary members (lagging or sheeting) added to the calculated deflection for primary member may be 50 percent greater than the limits identified when struts are placed no more than 5 feet apart on center, or piles are spaced no more than 8 feet apart on center.

4. If at any time the measured deflection exceeds the allowable maximum deflection, immediate corrective measures shall be taken by the Contractor to prevent any further deflections.

5. The Contractor shall stop the excavation work until corrective measures have been taken and the deflections have been reduced to acceptable limits, as specified.

3.5 REMOVAL OF SHORING

A. Shoring shall be designed to be gradually removed as necessary to allow backfill to be placed and compacted. All voids existing behind the shoring which remains in place shall be backfilled as specified in Section 02310 - EARTHWORK.

B. Shoring shall be removed as backfilling progresses. Removal shall be conducted in such a manner so as to avoid any damage to adjacent facilities**,** or to other members of the shoring system. Impact loading in members of the shoring system will not be allowed. All wood forms, loose or casual wood and debris shall be removed. Areas that cannot be accessed or achieve adequate compaction shall be backfilled with approved Controlled Low Strength Material (CLASM) per SSPWC 201-6 at no additional cost to the City.

C. During backfilling, temporary support elements shall not be removed until alternative support is available, such as substituted struts, backfill, or ability of the support system to act as a cantilever without detrimental deflection.

D. Portions of shoring used to support excavations for installation of sanitary sewer and storm drain facilities shall be removed or the pipe bedding and side support shall be recompacted to the satisfaction of the Engineer.

(END OF SECTION)

SECTION 02310
EARTHWORK

PART ONE - GENERAL

1.1 SUMMARY

A. Provided and execute earthwork as indicated on the Contract Drawings or in the Project Manual including but not limited to the following:

1. General excavating and trenching for various trades.

2. General exterior grading and cutting.

3. General excavating for site improvements.

4. Select base materials for under concrete slab and under paving.

5. Filling and Backfilling.

6. Treatment for termite control.

7. Structure excavation, unclassified fill and borrow excavation defined in Section 300 – EARTHWORK of the "Standard Specifications for Public Works Construction (SSPWC)".

B. RELATED WORK SPECIFIED ELSEWHERE

1. Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, DIVISION 1 - GENERAL REQUIREMENTS and other applicable Sections of the Project Manual.

2. Demolition in Division 2.

3. Clearing, Grubbing and Stripping in Section 02210.

4. Shoring in Section 02240.

5. Yard and Street Work in Section 02710.

6. Concrete Work in Division 3.

1.2 QUALITY ASSURANCE

A. Labor: Use adequate numbers of skilled laborers to are thoroughly trained and experienced in the necessary crafts and who are completely familiar with specified requirements and the methods needed for proper performance of the Work of this Section.

B. Equipment: Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

C. Codes and Standards: Perform excavation work in compliance with applicable

ordinance of governing authorities having jurisdiction including, but not limited to, the (2022 or latest edition) L. A. City Building Code and applicable Amendments; Division 1-DEPARTMENT OF INDUSTRIAL RELATIONS of Title 8 of the California Code of Regulations; Section 300 - EARTHWORK of SSPWC, as amended by Brownbook.

1. In addition to complying with Codes and Standards having jurisdiction, comply with directions of the Soil Engineer.

D. The Contractor shall provide necessary measures for storm water pollution control and water quality protection. The Contractor shall meet the standards of good housekeeping at all times.

E. Testing and Inspection Services: The City will engage a qualified soil testing and inspection service for quality control testing during earthwork operations. Testing shall be performed in accordance with the soil investigation reports and testing standards, the instructions of the Soil Engineer and the applicable Sections of General Conditions.

F. Geotechnical Engineer: The City will retain the services of a Soil Engineer for the purpose of soil investigations and testing, all the necessary inspections and observations, and certifications.

G. Survey: The City shall employ the services of a California licensed surveyor for the purposes of survey control, layout, grade and cross-sections required to control work. Survey work shall conform to Section 01722- SURVEYING.

1.3 SUBMITTALS

Conform to provisions of Section 01330 of DIVISION 1 - GENERAL REQUIREMENTS.

A. Shop Drawing of the Shoring System in Section 02240.

B. Sources of imported materials.

C. Method of Back-Filling and Compaction.

D. Dewatering Plans.

E. California General Construction Activity Stormwater Permit, Waste Discharge Identification Number, Wet Weather Erosion Control Plan or Stormwater Pollution Prevention Plan. (where applicable per GR 01571)

F. Competent Person Trench/Excavation Certification Form in Section 02240 – SHORING.

G. Test Reports-Excavating: Contractor shall submit the following reports directly to the Los Angeles City Department of Building & Safety, prepared by the Soil Engineer and the testing service, with a copy to the Engineer.

1. Test reports on borrow material.

2. Verification of each footing subgrade.

3. Field density test reports.

4. One optimum moisture-maximum density curve for each type of soil encountered.

5. Other test reports as required by the Soil Engineer and the local cognizant agency.

1.4 PERMITS

A. Required: In addition to the requirements specified herein, and in applicable Section 01112 – DESCRIPTION OF WORK of DIVISION 1 - GENERAL REQUIREMENTS of the Project Manual.

B. The Contractor shall perform all work in accordance with the permit requirements of the Los Angeles City Department of Building and Safety, including obtaining the grading permit, hauling permit and bond, and making the notification to the adjacent property owners; no additional compensation will be allowed therefore.

C. The Contractor shall furnish to the Engineer with a duplicate copy of the OSHA excavation permit, and all other required permits prior to the start of the excavation work.

D. The Contractor shall obtain and pay for the Bureau of Engineering's Shoring (Lateral Support) Permit.

E. The Contractor shall obtain and pay for the California State Regional Water Quality Control Board (LARWQCB) Construction Water Discharge Permit.

F. The Contractor shall obtain and pay for Calif General Construction Activity Stormwater Permit. The Contractor shall obtain Waste Discharge Identification Number after submitting Wet Weather Erosion Control Plan (WWECP) pursuant to Section 61.02 and 64.72 of L.A.M.C. or Stormwater Pollution Prevention Plan (SWPPP) pursuant to Section 91.106 of L.A.M.C. to the Los Angeles City Dept. Building and Safety for reviews.]

G. The Contractor shall make all necessary notifications, obtain and pay for required permits and file manifests with the South Coast Air Quality Management District (S.C.A.Q.M.D.).

1.5 JOB CONDITIONS

A. Required Work Coordination: The Contractor shall fully coordinate the work operations of this Section with that of other trades involved and with the Engineer to assure proper sequence of work, limitations, methods and time of work so as to minimize or avoid interference with the existing utilities as well as performance of work by the other Contractors. Contractor shall include minimum two weeks in its Construction Schedule to allow the Geotechnical Engineer to prepare final Geotechnical Data Report to be submitted to the Los Angeles City Department of Building and Safety Grading Division for final approval if the Geotechnical Engineer is obtained by the City. The Contractor shall coordinate and arrange for all the inspections with the local authorized agencies and the Bureau of Contract Administration.

B. Trench Safety: Attention is directed to the provisions of Section 6705 of the Labor Code and Section 02240 – SHORING of the Project Manual concerning trench excavation safety plans.

C. Air Pollution Control: The Contractor shall comply with all air pollution control rules, regulations, ordinances and statutes which apply to work performed pursuant to the Contract, including any air pollution control rules, regulations, ordinances and statutes, specified in Section 1107 of the Government Code.

D. Use of Pesticides: The Contractor shall comply with all rules and regulations of the Department of Food and Agriculture, the Department of Health, the Department of Industrial Relations and all other agencies which govern the use of pesticides required in the performance of the Work on the Contract.

1. Pesticides shall include, but shall not be limited to herbicides, insecticides, fungicides, rodenticides, germicides, menatocides, bactericides, inhibitors, fumigants, defoliants, soil sterilants, and repellents.

2. Any substance or mixture of substances intended for preventing, repelling, mitigating or destroying weeds, insects, diseases, rodents, or nematodes and any substance of mixture for substances intended for use as a plant regulator, defoliant shall be considered as a pesticide.

E. Sound Control Requirements: The Contractor shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the Contract.

Each combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without said muffler.

F. Use of Explosives: The use of explosives is not permitted.

1.6 PROTECTIONS

A. General: Comply with provisions of Section 00309 - PROTECTION OF PERSONS AND PROPERTY AND RESTORATION OF EXISTING IMPROVEMENTS in GENERAL CONDITIONS. Protect and guard all excavations against damage to life, limb and property as prescribed by Los Angeles City Department of Building and Safety.

B. Protections of Persons and Property: Provide and install signs, lights and barricades at danger points on and off the job-site to guard against accidents, etc.

1. Barricade open excavations occurring as part of this work and post with warning lights.

2. Operate and maintain warning lights as recommended by authorities having jurisdiction.

3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

4. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from drainage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

C. Existing Improvements (including trees and shrubs Indicated to Remain): Protect against damage resulting from Contractor's operations. Repair or replace damaged items to the full satisfactions of the City at no added cost to the City.

D. Shoring, Cribbing and Lagging: Required of excavations and earthbanks as necessary to prevent caving in, erosion or gullying of sides. Conform to applicable provisions in Section 02240 – SHORING of the Project Manual.

1. Design and calculations of shoring, etc. shall be in accordance with requirements of with the latest Los Angeles City Building Code, Section 2811 and Safety Orders of State of California, Division of Industrial Safety, Title 8, Subchapter 4, Article 6, Sections 1540 and 1541.

2. Upon completion of project or when no longer needed or otherwise directed by the authority having jurisdiction, remove all such shoring from the job-site.

E. Water: Divert or pump out of all excavations until concrete and other items are placed therein, forms removed and backfilling is completed. The Contractor shall provide a means for solids removal before discharging the water.

F. Existing Utilities: Utilities shown on the drawings are shown pursuant to a search of available records and are shown as a matter of information and not as a matter of fact. Conforming with Section 01112 - SUMMARY OF THE WORK, Section 01140 – CONTRACTOR'S USE OF THE PREMISES and other Sections of the Project Manual, the Contractor shall locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult City immediately for directions. Cooperate with City and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Company.

2. Do not interrupt existing utilities serving facilities occupied and used by City and others, during occupied hours, except when permitted in writing by the Engineer and then only after acceptable temporary utility services have been provided.

3. Provide a minimum of 48-hour notice to the Engineer, and receive written notice to proceed before interrupting any utility. Obtain clearance and notify all utility companies in the area and call Underground Service Alert by calling (800) 422-4133. Deliver utility clearance ticket number to the Engineer prior to the start of any work.

4. Demolish and completely remove from site existing underground utilities indicated to be removed**.** Coordinate with utility companies for shut-off of service if lines are active.

1.7 INSPECTION

A. Required: All excavations and trenches shall be inspected by the Los Angeles City Building and Safety Inspector, and the Soil Engineer before filling, backfilling and/or other subsequent work is placed therein.

1. Earthwork backfill for structures shall comply with requirements of Section 300-3.5 - STRUCTURAL BACKFILL of SSPWC and/or requirements in the Project Manual.

1.8 SOILS INFORMATION

Contractor shall comply with all Soils Report recommendations specified and other instruction directed by the Engineer. In case of conflicts between other part of the Project Manual and Soils Report the most restrictive condition shall govern unless otherwise approved by the Soil Engineer.

1.9 MATERIAL HANDLING

A. Delivery: All materials, tools, equipment, etc. to be delivered to the job-site, in such a manner coordinated with progress of work of this Section.

B. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or dispose of in accordance with Section 300-2.6 - SURPLUS MATERIALS of SSPWC. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

2. Dispose of excess soil material and waste materials as herein specified.

PART TWO – PRODUCTS

2.1 SOIL MATERIALS

A. Suitable Excavated Material: Suitable materials from excavations for use in fill and embankments shall be free from shale, sod, large clods or hard lumps of earth, roots, trash or other debris; that has a liquid limit of less than 30 and a plasticity index of less than 9; and is readily compatible to specified density. No rock, cobbles or broken concrete exceeding 2 inches in maximum dimension shall be placed in compacted fill without the specified approval of the Engineer. No rock, cobles or broken concrete exceeding 1 inch in maximum dimension shall be placed in compacted fill of the utility trench.

B. Fill Material: Furnish imported earth material as necessary; if specified in the contract requirements or if the amount of suitable earth materials obtained from the job-site excavations is not sufficient to properly construct the required fill, subject to the approval of the Engineer or the Soil Engineer prior to use.

1. Submit imported fill material samples and testing results for the Engineer's approval prior to importing to the job site in accordance with Section 300-5 BORROW EXCAVATION of SSPWC.

2. Imported fill material shall be free of foreign materials, vegetable growths, sod, rocks, expansive soils and all debris.

3. Lime for Treatment of Imported Fill Material: As here after specified in accordance with Section 301-5 - LIME-TREATED SOIL of SSPWC.

4. Where fill material exhibits a wide variation in consistency, the Engineer

may require blending to stabilize and upgrade the material as directed by the Engineer.

5. In landscape (planting area), fill shall not be saline or contain anything that would prevent normal plant growth: See LANDSCAPING, Section 02900 of the Project Manual for verification of required or approved fill material.

C. Base Material: "Crushed Aggregate Base", 3/4-inch maximum size aggregate, or “Crushed Miscellaneous Base”, 1-1/2-inch maximum size aggregate**,** as specified in Section 200-2 - UNTREATED BASE MATERIALS of SSPWC.

D Pipe Bedding and Trench Backfill Material:

1. Use clean earth materials as above specified free from clay, rock or gravel larger than 1-inches for utility trenches, clay, rock or gravel larger than 2" inches in an area other than utility trench subject to the Soil Engineer’s approval prior to use.

2. For sanitary sewer pipe, use Case I bedding material and extend 12-inch above said pipe, the balance of backfill to be approved clean earth materials.

3. For storm drain pipe, use approved washed sand and extend 4 inches above said pipe, the balance of backfill to be approved clean earth materials. For storm drain pipe section located beneath the sidewalk paving and connected to concrete curb outlet, sand bedding and backfill are not applicable.

4. For water pipe or pipe rise, use approved washed sand and extend 12-inches above said pipe, the balance of backfill to be approved clean earth materials.

5. For electrical conduits, use approved washed sand and extend 4 inches above said conduits, the balance of backfill to be approved clean earth materials. For utility service connection, provide bedding and backfill material in accordance with utility company’s instructions.

6. For the landscape irrigation piping, use approved washed sand and extend 4-inches above said pipe, the balance of backfill to be an approved clean earth material.

7. Conforming to applicable Sections of the Project Manual for the pipe bedding widths and depths.

E. Soil Cement: Use the soil-cement to form a dense, uniform mass conforming to the lines, grades and cross sections shown on the Contract Drawings. The soil cement shall be mixed, placed and compacted at least 95% of the relative compaction, in accordance with Section 301-3 of SSPWC and the instructions of the Soil Engineer.

F. Structural Backfill: The structural backfill shall have a sand equivalent of not less than 20 in accordance with Section 300-3.5 - STRUCTURAL BACKFILL and Section 300-4.5 - PLACING MATERIALS FOR FILLS of SSPWC, and placed and compacted to 90% of relative compaction.

G. Slurry Backfill: Slurry backfill shall be 60 E 0.7 (Class 100-E-100) and placed in accordance with Section 306-1.3.1 - BACKFILL AND DENSIFICATIONS of SSPWC.]

H. Drainage Fill Material: Crushed Rock conforming to ASTM C131 – TEST METHOD FOR RESISTANCE TO DEGRADATION OF SMALL SIZE COARSE AGGREGATE BY ABRASION AND IMPACT IN THE LOS ANGELES MACHINE and Section 200-1.2 - CRUSHED ROCK AND ROCK DUST of SSPWC.

2.2 WEED KILLER/SOIL STERILANT

Provide a dry, free-flowing, dust-free chemical compound, soluble in water, capable of inhibiting growth of vegetation, and approved for use on this Work by governmental agencies having jurisdiction.

A. Tinted for visual identification, shall be as follow:

1. United States Borax Corp. “Polyborchlorate” or equal.

2. Pacific Coast Borax Co. “Polyborchlorate”.

3. Amspray Corp. “Pavex”.

4. Elanco “Spike 801".

2.3 TOPSOIL

A. Where required by and shown on the Landscape Drawings or otherwise required, provide topsoil consisting of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2 inches in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter.

2.4 OTHER MATERIALS

Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART THREE - EXECUTION

3.1 SURFACE CONDITIONS

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected.

3.2 WATER QUALITY PROTECTION

A. Eroded sediments and other pollutants must be retained on side and may not be transported from the site via sheet flow, swales, area drains, natural drainage, or wind.

B. Stockpiles of earth and other construction-related materials must be protected from being transported from the site by wind or water.

C. Fuels, oils, solvents, and other toxic materials must be stored in accordance with their listing and are not to contaminate the soil ~~n~~or the surface waters. All approved toxic storage containers are to be protected from the weather. Spills must be cleaned up immediately and disposed of in a proper manner. Spills may not be washed into the drainage system.

D. Excess or waste concrete may not be washed into the public way or any drainage system. Provisions shall be made to retain concrete wastes on-site until they can be appropriately disposed of or recycled.

E. Trash and construction-related solid wastes must be deposited into a covered receptacle to prevent contamination of rainwater and dispersal by wind.

F. Sediments and other materials may not be tracked from the site by vehicle traffic. The construction entrance roadways must be stabilized so as to inhibit sediments from being deposited into the public ways. Accidental depositions must be swept up immediately and may not be washed down by rain or by any other means.

G. Comply with requirements shown in [Wet Weather Erosion Control Plan (WWECP).

3.3 CONTAMINATED SOIL

A. The following requirements apply to handling and disposing of contaminated soils or debris encountered during site excavations.

1. The Contractor shall be licensed for hazardous materials handling and hauling or have a qualified licensed subcontractor on call to provide a site-specific Health & Safety Plan and supervise sampling and chemical analysis of potentially-contaminated soils or debris. The Plan should specify particular action levels for each contaminant found during exploratory drilling and suspected to occur along the project alignment or within the site and provide guidelines for personal safety and public protection, including monitoring and appropriate personal protective equipment needed on the jobsite during all phases of excavation of the project.

2. The workers exposed to or handling contaminated soils shall have sufficient health and safety training, consistent with OSHA Hazardous Waste Operation Standards (29 CFR 1910.120), and Cal-OSHA “Hazardous Waste Operations & Emergency Response” (8 CCR 5192). The contractor, qualified subcontractor or an industrial hygienist shall prepare a site-specific health and safety plan. The plan shall appoint a site safety officer and establish responses to contaminants, including methane gas, known to exist in the area based on site knowledge and/or a Phase II Site Assessment Report.

3. Soils which have visible staining or an odor shall be tested in the field by the contractor or qualified environmental subcontractor with an organic vapor analyzer (OVA) for volatile components, which require additional considerations in their handling and disposal. Soil with OVA readings exceeding 50 ppm volatile organic compounds (probe held 3 inches from the excavated soil face), or which is visibly stained or has a detectable petrochemical odor shall be stockpiled by the Contractor separately from

non-contaminated soils. If volatile compounds are present at concentrations exceeding 50 ppm, an SCAQMD Rule 1166 permit will be required, which most likely will require control of vapor, such as covering the stockpiles with plastic sheeting or wetting with water or a soap solution. The Contractor shall obtain all permits.

4. The stockpiles shall be barricaded near the excavation area, away from drainage areas or catch basins, on an impermeable plastic liner (6 mil nominal thickness and tested at 100 psi strength). Caution must be taken to separate any contaminated soil from the remainder of the excavated material. If only a small amount of contaminated soil is encountered, it may be drummed in 55-gallon steel drums with sealing lids. Sealed soil bins may be required on larger projects and/or those in residential areas.

5. The stockpiled soil shall be sampled in a random and representative manner. To establish waste classification, samples shall be analyzed for Total Recoverable Petroleum Hydrocarbons (TRPH), volatile organics (VOC), TPH as gasoline or diesel if these fuels are found in the area, Title 22 heavy metals, reactivity (pH), corrosivity and toxicity. The number of samples will depend upon the volume of material removed, one sample for approximately every ton of soil. Storage space available at the site and site occupant sensitivity will determine the amount of soil that can be stockpiled. Suspected contaminated soil samples can be taken to a State-certified environmental laboratory or tested in the field with a mobile lab. Materials with elevated levels of TRPH, metals or other regulated contaminants will require handling by workers who have been adequately trained for health and safety aspects of hazardous material handling.

6. In older areas of the City, unanticipated types of hazardous waste are sometimes encountered, even if not discovered in the site assessment investigations. Should potential biohazards (such as medical waste material or syringes), lead-based paint, mercury-containing lamps or thermostats, PCB-containing transformer ballast, or asbestos-containing materials as “Transite” pipe be suspected, appropriate chemical tests shall be taken to verify the presence and concentrations of these contaminants before they are disturbed. All appropriate U.S. EPA and Cal-OSHA regulations must be followed; generally specialty licensed hazmat remediation and/or air monitoring firms with certified personnel must be employed.

B. Removal and Classification of Excavated Soil

1. Any contaminated material (soil, asphalt, concrete, railroad ballast, trash fill or debris) that is to be hauled off the site is considered a "waste product" and must be classified as hazardous or nonhazardous waste under all criteria by both State and Federal Codes prior to disposal. If the waste soil or other material is determined hazardous, a hazardous waste manifest will be prepared by the Contractor or its qualified representative and the material transported to an appropriate class of facility for recycling or landfill disposal by a registered hazardous material transporter. If the soil is nonhazardous but still exceeds levels that can be returned to the excavation or is not needed on the site, a less costly nonhazardous transporter and soil recycling facility shall be used if no hazardous constituents are present above their respective action levels.

2. Soil with levels of 100 ppm TRPH (crude oil, waste oil and diesel), 10 ppm gasoline, and 1/50/50/50/ ppm benzene, toluene, ethylbenzene and xylenes needs to be moved offsite. Soil contaminated with hydrocarbons at values less than these values may be backfilled, used for fill or paved over. All excavated material moved offsite must be manifested, transported by a registered hauler, and disposed of in the proper class landfill or recycler.

3. The Contractor shall notify Inspector of all contaminated material removals, and provide copies of signed manifests.

C. Contaminated Groundwater

1. Water quality may vary over the project excavation. Contamination with fuel hydrocarbons, heavy metals and high mineral content is possible. Should any dewatering be needed for excavation bottoms, the extent shall be minimized, sufficient to remove interior or nuisance water from structures. Dewatering minimization is required to avoid moving potential contamination plumes nearby and to avoid settlement of nearby structures. Cut-off methods such as using interlocking sheetpiles or slurry/grout walls may be used. Dewatering plans shall be prepared by the Contractor or qualified Geologist and reviewed and approved by the Engineer before dewatering operations begin. Sampling ports should be provided in the dewatering system.

2. The produced water shall be temporarily stored in large Baker-type tanks and analyzed by a State-certified environmental laboratory selected by the contractor. If the groundwater quality falls within guidelines established by the Bureau of Sanitation, Department of Public Works, a permit may be obtained to discharge the water into a nearby sewer. A NPDES permit from the Los Angeles Regional Water Quality Control Board will be required for any discharge into the storm drain system. If hydrocarbon or other water contamination precludes this, the water will have to be treated onsite (such as in an oil-water separator) or hauled off-site in vacuum trucks to a local water treatment facility.

3.4 SITE PREPARATION

A. Excavate 6 inches of existing soil including debris, roots and foreign materials under the landscape area prior to recompaction (to 95% relative compaction).

B. Subgrades: Scarify for recompaction to a depth of 6-inches, bring to optimum moisture content and then recompact to at least 95% maximum density for subgrade as per ASTM D1557 - TESTED METHOD FOR LABORATORY COMPACTION CHARACTERISTICS OF SOIL USING MODIFIED EFFORT (56,000 FT - LBF/FT^3.). Prepare subgrade in accordance with Section 301-1 - SUBGRADE PREPARATION of SSPWC.

C. Holes and trenches existing on the job-site or resulting from Contractor's operations shall be filled with clean existing or imported earth materials (free of large clods and stone).

Unless indicated otherwise, construct fill in accordance with Section 300-4.5 - PLACING MATERIALS FOR FILLS of SSPWC in 8-inch layers and each layer compacted to 95% relative compaction and finished to elevations necessary to require cutting by fine grading. Inspection by Los Angeles City Building and Safety

Inspector and the Soil Engineer are required prior to filling. Obtain minimum one compaction test for each layer or volume specified by Code.

D. Grading: To elevations of existing adjoining street surfaces, private property and surfaces immediately adjacent to the job-site limits indicated on the Contract Drawings; make all grades in a straight line from any point to any other perimeter point.

E. Dewatering:

1. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.

2. Keep excavations and site construction area free from water.

F. Dust Control: Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the job-site.

G. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Apply water in manner to prevent free water appearing on surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

H. Rework: Any previously compacted or tested subgrade and fill material, which are affected or disturbed, in the opinion of the Soil Engineer, by the inclemency of the weather such as rains, floods, earthquake or others shall be reworked, retested and re-inspected at no additional cost to the City.

I. Approval of Subgrade**:** By the Soil Engineer and the Los Angeles City Building and Safety Inspector prior to placing any fill.

J. Subgrade Preparation Where Extensive Fills Will Occur:

1. Remove disturbed existing soils and stockpile materials approved by the Soil Engineer for use in fills and as backfill materials. Dispose unsuitable materials off the job-site.

2. Subgrade to be approved by the City of Los Angeles Building and Safety Inspector and the Soil Engineer.

3. Scarify the upper 6 inches of the soil over the entire rough grade site and recompact to a minimum relative compaction of 95%.

4. Bring to designated rough grades, using existing on-site or imported materials, as approved by Soil Engineer, regrade by removing and replacing materials in loose lifts and bringing to optimum moisture content

and compacting to 95% relative compaction as above specified for exposed soils to receive fills. Use granular material for fills behind retaining walls.

5. Testing of Fills: Test the fill for conformance with code requirements; under continuous control supervision of The Inspector. The Inspector shall keep a log of the tests performed which will be filed with the Engineer upon completion of the work. Contractor to bear the costs of rework, retesting and re-inspection because of non-conformance.

3.5 GRUBBING AND GRADING

A. Remove entire roots under the footings and elsewhere to; (1) 1.5 feet below the new finished elevation of each surface if roots are 1-1/2 inches in diameter or smaller and, (2) 3 feet below the new finished elevation of each surface if roots are 1-1/2 inches in diameter or larger.

B. Rough: Leave cut and fill sufficiently high to require cutting by fine grading.

C. Fine: To elevations required to ensure proper drainage or finished elevations indicated on drawings; finish elevations for planting areas as specified for top soil fill in Section 02900 – LANDSCAPING.

D. Subgrade Preparation: Required for all areas, other than filled or backfill areas, over which moisture barrier material, slabs, walks or pavement will be placed; in accordance with provision specified herein and Section 301-1 - SUBGRADE PREPARATION of SSPWC.

E. Inspection Required: Prior to placing base material, concrete or other materials.

F. Grading for Demolition Jobs: To specified elevations or elevations of existing sidewalks, adjacent property lines or surfaces immediately adjacent to the sites. Make all grades straight-line from any point to any other perimeter point.

G. Grading for New Asphalt Concrete Paving:

1. Rough: Cut and fill to be left sufficiently high to require cutting by fine grading and preparation of the surface for placement of the required select base material to thickness noted on the Contract Drawings or matching that of adjacent existing select base materials.

2. Fine: To exact elevations necessary for required new paving and paving repairs.

3. Testing and Inspection Required: Prior to placing of select base and asphalt paving materials.

3.6 EXCAVATING

A. General:

1. Excavation consists of the removal and disposal of materials necessary to establish required grade elevations and certified compacted fill for new construction pursuant to Section 300-2 UNCLASSIFIED EXCAVATION of SSPWC.

2. Excavated materials suitable for use as fill and/or backfill to be stockpiled where directed by the Engineer.

3. Non-approved and excess excavated materials to be legally removed and disposed of from the job-site.

4. Shoring, Bracing and Bulkheading of Trenches: All to be provided, installed and maintained where required to support trenches, See Subsection 1.6 of this Section. Conform to the requirements prescribed by the Los Angeles City Department of Building and Safety, CAL/OSHA, Section 02240 - SHORING and other Sections of the Project Manual.

5. Access to Trenches: Conform to Section 306-1.1.4 - ACCESS TO TRENCHES of SSPWC. Provide safe and suitable ladders, which project 2 feet above the top of the trench. It shall be provided for all trenches over 4 feet in depth. Minimum one ladder shall be provided for each 50 feet of open trench or fraction thereof, and be so located that the workers in the trench need not move more than 25 feet to a ladder.

6. Encountered Existing Underground Piping or Conduits: Immediately stop the trench operations at the point of encounter, notify the Engineer of such condition and submit support drawings to the Engineer for approval. The support drawings shall be in conformance with the Los Angeles City Bureau of Engineering Standard Plans S-253**,** SUPPORTS FOR STORM DRAIN AND SEWER PIPES ACROSS TRENCHES, latest edition; CAL/OSHA and the utility company's requirements.

B. For Substructure Concrete:

1. When Earth Banks are Stable: To net sizes of concrete, except as otherwise specified or indicated on the Contract Drawings.

2. When Earth Banks are not Stable: Sufficiently wider than concrete to allow for forms and inspection thereof.

3. Where Rock Occurs: Surface to be leveled to a clean, even hard surface.

4. Depth: As indicated on Contract Drawings.

5. Excessive Width and Depth: Where excavation is made wider and deeper than required, fill with concrete specified in Section 03300 of the Project Manual, at Contractor's expense.

6. Inspection Required: After excavation and before placing concrete and before backfilling, the exposed soil or subgrade will be carefully inspected by the City of Los Angeles Building and Safety Inspector and the Soil Engineer to verify removal of additional unsuitable soil.

7. Protections and Shorings: See Subsection 1.6 of this Section.

8. Excavation for Grade Beams: Omit forms when sides will stand to a cut face, make such excavation 1-inch wider on each side.

9. When excavating adjacent to existing remaining structures, do so in a sequence as required and approved by the Engineer to avoid displacement or damage to the existing adjacent structure.

C. For Site Improvements:

1. Masonry Yard Walls: As necessary for required footing and setting of forms for concrete work, to depth indicated.

2. For Planter Curbs: To exact curb limit, without excessive removal of adjacent paving or subgrade for new paving.

3. Planter Areas: Excavate 6-inches of existing sub-soils as necessary to receive topsoil fill as specified in Section 02900 - LANDSCAPING.

4. For Bumper Posts**:** To dimensions and depths noted on the Contract Drawings.

5. For Concrete and Asphaltic Site Improvements such as concrete and/or asphalt pavements, concrete walkways, driveways aprons, concrete curb and gutter: Excavate to exact limits of such work without excessive removal of existing subgrade. Scarify and compact top 6 inches of subgrade and compact at 95% relative density.

D. For Walls (including wall footings): Width not less than 18-in. from face of wall and sufficient for necessary forms, cribbing, bracing, inspection, and application for watering on walls, where required.

E. Conduit and Piping: Conforming to the requirements as specified on the drawings, Los Angeles City Plumbing Code, SSPWC and other sections of the Project Manual. Any piping with 8 feet or less cover or backfill, Case 1 Bedding Installations of Los Angeles City Bureau of Engineering Standard Plan S-251, latest edition, shall be used for all piping laying unless otherwise specified on the drawings or noted.

1. Depth and Width of Trench For Storm Drainage Piping: To depth necessary for installation of piping and construction of catch basin in accordance with requirements of Section 02545 - STORM DRAIN SYSTEM, PLUMBING Section in Division 15 of the Project Manual and as noted on the Contract Drawings. Provide minimum 12 inches side clearance from side of the piping. Make the sides vertical and the bottoms smooth, firm, level or uniformly sloped as required, slope to not exceed a downward slope of two horizontal to one vertical in a manner to prevent formation of water pockets in the pipe. For backfill or earth cover exceeded 8 feet, refer to Los Angeles City Bureau of Engineering Standard Plan S-251, latest edition, for maximum allowable trench width and bedding material. Unless specified otherwise, provide minimum 2 inches washed sand bedding below the pipe barrel.

2. Depth and Width of Trench for Plumbing Piping: As necessary for complete installations of the piping, fixtures and controls; provide minimum 12 inches side clearance from side of the piping; make the sides vertical and bottoms smooth, firm, level or slopes, as required by the code for proper drainage. Final elevations shown on Contract Drawings shall mean the invented pipe elevations. Pipe thickness and bedding thickness shall be used in determining trench depths. Conform to the requirements as specified in the Los Angeles City Plumbing Code and in Division 15 of the Project Manual. For backfill or earth cover exceeded 8 feet, refer to Los Angeles City Bureau of Engineering Standard Plan S-251, latest edition,

for maximum allowable trench width and bedding material. Unless specified otherwise, provide minimum 4 inches washed sand bedding below the pipe barrel.

If final elevation is not shown on contract drawings, place all piping to a depth no less than 24 inches.

3. Depth and Width of Trench for Electrical Conduit and Pull Box: As necessary for complete installation of the electrical conduits and pull box, unless specified otherwise, provide minimum 7 1/2 inches side clearance from the side of the conduit and pull box and 2 inches sand bedding in accordance with the Contract Drawings and requirements of the Utility Company.

   Conduit shall be placed to a depth of not less than 24 inches and 36 inches under the driveway.

4. Depth and Width of Trench for Landscape Irrigation Piping: As necessary for complete installations of the piping fixtures and controls; provide a minimum of 7 1/2 inches side clearance from the side of the piping and 4 inches washed sand bedding. Depth of piping shall be conformance with Section 02810 – IRRIGATION SYSTEMS of the Project Manual. All trenches for electrical conduit and wiring shall be in accordance with requirements listed hereinbefore.

F. For Underground Tanks: To necessary depth for proper installation of underground tanks as specified in DIVISION 15 in accordance with requirements of Los Angeles City Municipal Code.

G. Corrections: Required of all unauthorized excavations made below indicated depths, as recommended by the Soil Engineer at no added cost to the City.

3.7 FILLING

A. General: Construct in accordance with Section 300-4- UNCLASSIFIED FILL of SSPWC and place in layers not exceeding 8-inches thickness, compacted to a relative compaction of not less than 95% when tested in accordance with Section 211-2 - COMPACTION TESTS of SSPWC, except that fill in planting areas may be compacted to 90% relative compaction.

B. In Planting Areas and Tree Wells: If flooding method is specified for fill material, place saturated fill (exclusive of topsoil fill) prior to construction of adjacent improvements to minimize settlement as follows:

1. Planting Areas and Holes: Cultivate and soak the specified backfill mix for a minimum of two days using a common lawn soaker.

2. Tree Wells: Excavate a sump approximately 3-feet square by 3-feet deep and flood each sump for about 3 days.

C. Fill all holes on the existing job-site or resulting from site-clearing or demolition operations.

D. Topsoil Fill: Specified in Section 02900 - LANDSCAPING of the Project Manual.

E. Inspection Required: Prior to placement of fill materials. See Subsection 1.7A of

this Section.

F. Concrete and Asphalt Site Improvements Walkways: Compact top 6 inches of existing subgrade and each 8" layer of backfill or fill material at 95% relative density.

3.8 BACKFILLING

A. Prior to Backfilling: Remove debris, trash and form materials from excavations.

B. Inspection Required: Prior to backfilling operations.

C. Placement of Backfill: In layers not exceeding 8-inches thickness, moisten to optimum moisture content and tamp until required 95% relative compaction is secured and finish to suitable elevations to provide for anticipated settlement and shrinkage.

D. Pipe Bedding And Backfill Over Underground Piping And Conduit: Place bedding and backfill material in conformance with provisions specified Subsection 2.1 (D) herein and in Section 02545 - STORM DRAIN SYSTEM, Division 15 - PLUMBING and Division 16 – ELECTRICAL of the Project Manual. Do not place backfill materials until the Inspector has inspected and approved the pipe installation. The bedding shall be compacted and shaped to form a firm base for the pipe and conduit. The initial backfill shall be placed in two lifts. The first lift shall be to the spring line of the pipe or conduit. The initial backfill shall be compacted by water densification method. The balance of backfill shall be placed in accordance with Subsection 3.8 (C) herein.

E. For Parking Lot or Demolition Jobs: Use clean material previously removed from excavations or use imported materials as hereinbefore specified subject to approval by the Inspector or Engineer.

F. For Backfill Against Basement Walls: Do not place until such walls have gained sufficient strength to resist backfill loads and backside of such walls have been properly waterproofed without prior approval of the Inspector. Bring backfill up to finish grade or to subgrade for paving as indicated on the drawings.

G. In Planting Areas Holes and Tree Wells: After planting, cultivate and soak the specified backfill mix for a minimum of two days using a common lawn soaker if specified.

H. For Voids Left by the Removal of Sheeting, Piles and Similar Shoring Supports: Immediately backfill with structural backfill of clean sand or slurry backfill which shall be jetted into place to ensure a dense and complete filling of the voids.

I. Slurry Backfill: In areas where specified and/or around the utilities, vaults or other structures where the Soil Engineer determines that it is not practical to attain the required compaction by the mechanical methods or water densification, provide a trench slurry backfill 60-E0.7 (Class 100-E-100).

3.9 SELECT BASE

A. Place in accordance with Section 301-2 - UNTREATED BASE of SSPWC and "Soil Report" recommendations.

B. Locations: Place select base beneath concrete and asphalt concrete yard paving, as noted on the Contract Drawings.

C. Thickness: As indicated on the Contract Drawings.

NOTE: Place to thickness matching that of original thickness of select base under existing removed concrete or asphalt concrete paving and make ready to receive paving repair materials. Aggregate base shall be compacted to 95% relative density in accordance with Section 301-2 - UNTREATED BASE of SSPWC.

3.11 SOIL STERILIZATION

Apply specified soil sterilization material to areas to receive select base materials and all exterior area including concrete and asphalt paving, concrete walkway, concrete curb and gutter, by methods recommended by the manufacturer. Certify in writing that the material has been applied.

3.12 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from City's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off City's property in a legal manner and to conform with the requirements shown in Section 01572 – CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT of Division 1 - General Requirements.

B. Provide written consent of the owner of the property upon which the surplus material is to be deposited, pursuant to Section 01572 – CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT specified above and Section 300-26 - SURPLUS MATERIAL of SSPWC.

END OF SECTION

SECTION 02455

CAST-IN-PLACE DRILLED PILES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Principal Work in this Section:

1. Provide cast-in-place drilled piles, complete, in accordance with Contract Documents.

B. Related Work Specified Elsewhere

1. Section 03200 - Concrete Reinforcement

2. Section 03300 - Cast-In-Place Concrete.

3. Section 03310 - Concrete Testing and Inspection.

1.2 SYSTEM DESCRIPTION

A. Work Includes, but is not limited to, the following:

1. Excavation for drilled piles, including soil and rock excavation, removal of existing concrete slabs, foundations and other obstructions as required.

2. Installation of temporary steel casing for protection of the tops of holes to prevent caving and material entering the hole.

3. Reinforcing steel, furnishing and installing reinforcing steel including reinforcing extending above top of shaft and dowels, as required.

4. Concrete for drilled piles, including mix designs with required supporting testing, furnishing and placing.

5. Disposal of excavated materials.

6. Establishing surveyed elevations and surveyed locations from established building line monuments which will be furnished and installed by a registered land surveyor.

7. Maintaining diameters of shafts.

8. Maintaining top of shaft elevations including removal of laitance.

9. Excavation and filling of trial drilled piles in advance of production drilling for the purpose of review by Contractor and City of Los Angeles Geotechnical Engineering Division of caving potential, equipment suitability, etc.

1.3 QUALITY ASSURANCE

A. Quality Assurance: Prepare and execute Quality Assurance program including concrete mix designs, materials report, sampling, and detailed shop drawings for reinforcing which provide no opportunity to complete unsatisfactory cast-in-place drilled pile work. Perform retesting or evaluation by Quality Control personnel due to deficient work, and similar work at no additional cost to Owner.

B. Quality Control: Cast-in-place drilled piles work may be subject to evaluation and tests in shop and field by others. Evaluations and testing undertaken by others is strictly for random evaluation. Extent, duration and amount of testing or evaluation is entirely at discretion of others. Use of testing services, or execution of testing or evaluation service by others shall in no way relieve Contractor's sole responsibility to furnish materials and construction in full compliance with Contract Documents.

C. Qualifications

1. Contractor engaging work of this section shall have minimum fifteen years of experience in work of similar scope and nature to that specified.

2. Contractor shall employ labor and supervisory personnel at least equally experienced in work of similar scope and nature to that specified.

D. Testing Agencies

1. Inspection/Testing: Coordinate and provide ample notification to the Geotechnical Engineering Division for observation of excavating and construction of the piles and to Contract Administration for inspection and testing of reinforcing and concrete work to allow the construction to proceed in a continuous operation.

2. Contractor's Concrete Testing Agency: Contractor shall employ at his own expense, testing laboratory acceptable to Architect, to design concrete mixes, conduct tests and submit reports as are hereinafter specified.

3. Geotechnical Engineering Division: Owner will retain, at his own expense, a geotechnical consultant, to conduct tests and inspections of soil conditions and submit reports as are hereinafter specified. Owner's geotechnical consultant will be responsible for inspections and for conducting and interpreting tests. Inspection will take the form of full-time inspection of pile excavation and concreting operations.

1.4 REFERENCES

A. Except as modified by governing codes and Contract Documents, comply with applicable revisions and recommendations of the following:

1. ACI

2. ASTM

3. PCA

1.5 SUBMITTALS

A. Product Data: Submit Product Data and installation instructions for the following items in accordance with Section - SUBMITTALS. Include laboratory test reports and such other data required to show compliance with Contract Documents.

1. Fly ash.

2. Plasticizing admixture.

3. Aggregate for stone concrete, including sodium sulfate soundness test (ASTM C88) and sieve analysis.

4. Reinforcing steel.

5. Portland cement (including certified mill test reports).

B. Shop Drawings: Submit Shop Drawings for the following items in accordance with Section - SUBMITTALS.

1. Provide Shop Drawings which show details and layouts of reinforcing steel in accordance with Section 03200- Concrete Reinforcing. All tie reinforcing shall have 135-degree hooks around vertical reinforcing at each end of each tie or each piece of continuously wound tie. Vertical reinforcing shall be positioned around pile to clear and coordinate with grade beam reinforcing and anchor bolts/column dowels.

C. Furnish detailed descriptions of construction procedures, equipment, temporary liners used and drilling methods.

D. Certificates of Site Examination: Submit, before proceeding with the work, one copy of certification in acceptable form stating that careful examination has been made of the site, existing structures, records of utility lines, test boring records, subsurface exploration reports, drawings and specifications, signed by the Contractor's Installer and the Contractor.

E. Test Reports: Test and inspection reports shall be submitted in accordance with Section QUALITY CONTROL by the following testing agencies; with one copy to Contractor and others as indicated.

1. Contractor's Concrete Testing Agency

a. Report and certification of aggregate for stone concrete, including sodium sulfate soundness test (ASTM C 88) and sieve analysis. (may be omitted if available from manufacturer).

b. Concrete design mix reports, listing all mixes required together with test results.

2. Owner's Concrete Testing Agency

a. Concrete test reports, indicating slump and test strengths at 7 days, 28 days and 56 days (if required) for test samples obtained, together with pertinent information and certification of compliance with strength requirements.

b. Ready-Mix Plant Inspection Reports, showing location of plant; mix number and strength; proportioning; source, type and amount of cement; admixtures; aggregates; water added and total water used; slump; air content; capacity and condition of mixing trucks; per cent of capacity loading practice; condition of batching equipment; period of inspection and number and size of batches observed.

3. Geotechnical Engineering Division:

a. "Drilled Piles Field Record" for each pile recording actual geotechnical data, including the actual depth or elevation of bottom, elevation of bearing strata (if applicable), result of all test performed, seepage of water, variation of shaft diameters (from those shown), and general description of bearing strata over the length of piles shaft. If rock is encountered, indicate depth to rock, and socket depth. Specific confirmation of the allowable load for the pile shall be included.

4. Record drawings: Update record drawings, specified in Division 1, to incorporate the above information including the final center line location of the top of each pile.

1.6 PROJECT CONDITIONS

A. Environmental Conditions

1. Contractor shall examine the site, drawings, records of existing utilities and construction, record of tests borings, and subsurface exploration reports to determine conditions under which the piles will be installed. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

2. An investigation of the soils has been made for the site which contains partial information on existing conditions and potential conditions on site for drilled piles work. The intent of these specifications is to include all recommendations given in the report and subsequent amendments, except where the Contract Documents are specifically more stringent.

B. Protection

1. During excavation of piles, openings shall be properly protected and covered when work is not in progress. Suitable fences, lights, etc., shall be provided as required. Contractor shall provide a protective cage or casing for inspection and testing of piles and to protect workmen during hand excavation or other operations requiring entry into shaft. The Contractor shall provide access down hole with proper safety equipment for the Geotechnical Engineering Division. Coordinate with the Geotechnical Engineering Division for required safety apparatus, prior to inspection. Holes shall be covered and protected, with casing in place, while tests are being made. Shells as required for construction loads shall satisfy safety requirements of the construction and regulatory agencies. Contractor shall have adequate gas detection devices on site at all times with personnel trained in their proper use. Contractor shall make tests for gas or noxious fumes prior to entry into the shaft and provide continuous monitoring when men are required to be in the shafts.

2. Contractor and piles installer shall take particular measures when drilling and constructing along existing buildings. Take all necessary measures to brace, shore, underpin and any other work or sequences to ensure maintaining the strength, stability and cause no damage to existing buildings.

3. Prior to any excavation adjacent to the existing building, record and photograph all existing conditions and send a report to the Owner. Monitor by measurement and record and photograph on a regular basis during construction and send reports to the Owner.

C. Contractor's bid shall be based on construction of piles to length shown on the drawings. Adjustment will be made on net variation of total quantities, based on the design dimensions for shafts. There will be no additional compensation for excavation or concrete due to overcutting or over lengthening of shafts (i.e., in any dimension) resulting from machine methods of excavation, or any other cause, unless directed by the Engineer in writing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type II normal Portland cements.

B. Fly Ash: ASTM C618.

C. Water Reducing and Plasticizing Admixture: ASTM C494, type and quantity recommended by manufacturer depending upon conditions at project site.

D. Aggregate for Stone Concrete shall comply with ASTM C 33 size 467 for placement "in-the-dry" and 3/4 inch maximum for tremie concrete and the following:

1. General: Aggregates when subjected to 5 cycles of sodium sulfate soundness test (ASTM C 88) shall not lose more than 15% by weight. Aggregates for the entire job shall come from the same source unless a change is acceptable to the Engineer.

2. Fine Aggregates: Natural or artificial hard, clean sand.

3. Coarse Aggregates: Gravel or crushed rock with clean, hard, uncoated particles.

E. Mixing Water: Clean, fresh and free from deleterious substances which would impair the work.

F. New Billet Steel Bars: ASTM A 615, Grade 60.

G. Temporary Steel Casing: Temporary steel casing shall be constructed of ASTM A36 steel plate. Longitudinal and transverse joints shall be full butt welds forming temporary casing to length and diameter required to control caving of shafts during excavation and to facilitate construction of the piles to the required diameter and length.

H. Ready-Mixed Concrete: ASTM C94, of strength as shown on drawings.

I. Miscellaneous Materials or Accessories shall be provided as specified hereinafter under the various items of work, as indicated on the drawings, and as required for good construction practice.

2.2 MIX DESIGN

A. Contractor's Concrete Testing agency shall design the mix for each type of concrete required in accordance with the requirements of the specifications and drawings. Strength requirements are as noted on drawings. Design mixes shall obtain strength (as determined by test cylinders) at least 15% higher than specified. Allow a minimum of 40 days prior to placing concrete for this work.

B. The adequacy of the design shall be verified by tests on a minimum of 9 cylinders; 3 tested at 7 days, 3 at 14 days, and 3 at 28 days in accordance with ASTM C192 and C39 and by a slump tests in accordance with ASTM C143.

C. Contractor shall prepare and submit a complete list of design mixes required for the project, together with test results, to Engineer for review before any concrete is placed. Design mixes may be initially submitted for preliminary review with the 7 and 14 day test results but the 28 day test results shall be reported prior to placing concrete.

The mix design submittal shall contain at least the following information: gradations for coarse and fine aggregate, cement type, aggregate sources, cement source, admixture data sheet from manufacturer's brochure, mix proportions, strength test results, actual slump of tested concrete mix, batch plant, etc. The submittal shall be signed by the preparer and the registered Civil Engineer experienced in concrete materials that is responsible for the mix design.

D. Contractor shall immediately notify the Owner's Concrete Testing Agency and Engineer if, at any time during construction, the concrete resulting from the mix design proves to be unsatisfactory for any reason such as: Too much water, lack of sufficient plasticity to prevent segregation, honeycomb, etc.; or insufficient strength. Contractor shall modify the design, subject to the Engineer’s review, until a satisfactory concrete is obtained.

E. Stone Concrete: Proportion in accordance with the following minimum requirements:

Design Strength psi	Cement Content* Sacks/Cu.Yd.	Water. Max Gal./Sack	Max.** Slump
4000	5-3/4	5.5	5" min to 7” max

* A plasticizing admixture shall be used and minimum cement requirements may be reduced by 1/2 sack per cu. yd. where a maximum of 75 lbs. of fly ash is substituted per cu. yd.

** Increase slump, provide retardation, etc. as necessary or required for excavation utilizing temporary liners.

F. Tremie Concrete: Proportion in accordance with the following minimum requirements:

Design Strength psi	Cement Content	Maximum Slump
5000 psi	705 lbs.	7 to 9 inch

* A plasticing admixture shall be used and minimum cement requirements may be reduced by 47 lbs. Where a maximum of 75 lbs. of fly ash is substituted.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements: Verify dimensions before proceeding with work. Obtain field measurements for work required to be accurately fitted to other construction. Be responsible for accuracy of such measurements.

B. Equipment: The Contractor shall use equipment of adequate capacity and proven methods for all drilled piles construction work including rock drilling. Drilling shall be accomplished by means of a power driven rotary bucket or auger type foundation drilling machine designed to excavate a plumb cylindrical shaft.

C. Methods: The drilling sequences and procedures shall be such as to produce negligible loss of ground as well as squeezing of the hole and consequent settlement. The contractor shall develop his construction procedure using the guidelines described and provide a description of the procedure for review and approval by Geotechnical Engineering Division.

3.2 INSTALLATION

A. Excavation

1. General: Excavated materials shall be removed from the site or utilized on the site in locations in accordance with construction activities as required and approved by the Engineer. The area shall at all times be kept clean and free of spoil and other debris which could affect the progress or safety of the work.

2. Machine methods shall be used for the excavation of pile shafts. Temporary steel casing shall be used to prevent caving of soil and to reduce seepage unless otherwise approved by the Engineer. The diameter of the bore of the hole shall be such as to reduce the annular space between the wall of the hole and the steel casing to a minimum.

a. Casing cutting, loss of temporary casing or portion thereof, extension/addition of piles, etc. shall be at expense of the Contractor.

b. Piles shall not be excavated closer than 4 diameters on center unless adjacent piles have been completed 24 hours.

c. Piles Shafts: Piles shall be founded in and on bearing strata capable of developing the minimum allowable pile capacity specified on the drawings. If test results indicate that the bearing strata is incapable of providing the required allowable capacity values, the shaft length may be advanced as directed by the Geotechnical Engineering Division .

d. The Geotechnical Engineering Division shall observe all pile excavating in order to report quality of bearing strata, penetration into bearing strata, conditions at the bottom and sides of the piles as well as report the confirmation of design allowable pile capacity.

B. Installation

1. Placing Concrete:

a. Do not start placing of concrete until the excavation and reinforcing for the whole unit to be placed has been completed, cleaned and dried, and inspected and approved by the Geotechnical Engineering Division.

b. Provide adequate runways, chutes, tremies and other means of conveying concrete into place. Use tremies for placing concrete. Use vertical pipe near the center of the piles extending into the concrete to control concrete placement.

c. Concrete placed in dry holes shall not be allowed to fall freely more than 5 feet. Concrete pumps, tremies or other such devices shall be used to comply with these requirements.

d. Concrete shall always be placed under water using concrete pumps and hoses, or equal, extending to the bottom of the pile excavation. A head of at least 4 feet of concrete shall always be maintained over the end of the concrete pump pipe so that water and disturbed soils are forced from the excavation.

e. Temporary casing shall be raised slowly as the pile excavation is filled with concrete, provided that the bottom of the casing is always a minimum of 5 feet below the level of the concrete.

f. Concrete placement shall continue until suitable concrete extends to the top of the pile excavation. The tremie or concrete pump pipe shall be slowly raised as the pile excavation is filled with concrete, provided that the bottom of the pipe is never more than 5 feet above the level of the concrete.

g. Piles spaced closer than 3 pile diameters center to center shall be drilled and concreted alternately, allowing at least 12 hours after concrete placement in one pile before drilling of an adjacent pile.

h. Place concrete immediately after mixing, and in no case, more than 60 minutes after water has been added. Continue the depositing of concrete in a continuous operation until completion of the piles to top of shaft, and in no case suspend the placing of concrete of a pile more than 30 minutes. Consolidate the concrete by vibrating the top 25' (7.6 m). Laitance and excess water shall be removed.

i. Concrete for piles shall be placed "in-the-dry" unless placement under bentonite or other equivalent slurry is determined by the Contractor to be necessary and confirmed by written approval of the Geotechnical Engineering Division. Standing water in puddles deeper than one (1) inch, loose soil and debris shall be removed from the bottom of shafts before concrete placement. If placement under slurry is necessary, use tremie concrete mix of 1000 psi higher strength than specified on the drawings which is for ”in-the-dry” placement.

j. Place concrete in piles immediately upon complying with the foregoing requirements.

C. Installation Tolerances

1. The maximum allowable variation of the center of the top of any piles from the required location shall be 4% of the shaft diameter or 3" (75 mm), whichever is less. The shaft shall not be out of plumb by more than 3 inch in 25 feet. If these tolerances are exceeded, additional work shall be performed as directed by the Engineer, at the Contractor's expense.

2. Piles shall have a minimum shaft diameter equal to that shown on the drawings. If the piles diameter is reduced, the Contractor shall design and furnish additional or corrective construction, acceptable to the Engineer, to compensate for loss of piles section, at no extra cost. The proposed corrective construction which may include additional piles, caps and grade beams shall be submitted to the Architect for review.

D. Corrective Methods

1. If observations and/or test results of the Geotechnical Engineer indicate that the soil is not capable of providing the required minimum allowable piles capacity value, the shaft length shall be advanced as directed by the Geotechnical Engineer, with the concurrence of the Architect.

2. Loose materials or free water in quantities sufficient to cause settlement or affect concrete strength, as determined by Geotechnical Engineer shall be removed from the bottom of the shaft.

3. If water or other conditions are found which make excavation through sand or silt strata dangerous to personnel or such as to cause excessive inflow of silt or sand creating voids outside the piles, the work shall be continued using an acceptable stabilization method or other alternative method, which are demonstrated by trial shaft in either case.

4. If concrete placement is suspended before completion of a pile or a construction joint is required for some other reason, show the detail and elevation of the joint on the as-built drawings.

5. If construction joints are required and the reinforcing cage is not required at the joint location, provide dowels of the same size and configuration as the reinforcing cage, suitably tied, with embedment sufficient to develop and bond strength of the bars.

3.3 FIELD QUALITY MONITORING

A. The Geotechnical Engineering Division will perform all tests hereinafter specified and any additional tests as may be required, and will prepare test reports:

1. The bottom elevations, bearing, and lengths of piles as shown on the drawings are estimated from the soil boring data. The actual elevations, pile lengths and load capacities shall be determined by the Geotechnical Engineering Division.

2. The Contractor shall notify the Geotechnical Engineering Division sufficiently in advance to allow observation of the shaft excavating and evaluation herein specified as soon as the desired level is reached.

3. The Geotechnical Engineering Division shall keep an accurate record of each pile excavation.

4. The bottom of the excavation for all piles shall be inspected as necessary by the Geotechnical Engineering Division.

5. The completed piles will be evaluated as directed by the Geotechnical Engineer by sonic gamma logging, cross hole logging or other means for voids or other indications of incomplete pile diameter at any elevation. Provide and install a minimum of two tubes in each pile for logging of the diameter and material as directed by the Geotechnical Engineer. Protect the tubes by sealing, filling with water, etc. and flushing out, prior to sonic testing by the Geotechnical Engineer. Provide coring equipment and core the test piles full length to evaluate concrete consistency and strength. Box the core and deliver portions for testing by the Owner's Concrete Testing Agency. Core other piles as directed at no additional cost where sonic testing or other evaluations indicate deficiencies in concrete consistency, strength, etc.

B. Concrete: The Owner's Concrete Testing Agency shall conduct the following tests and inspections during construction and immediately submit reports thereon to the Architect.

1. Compression Tests shall be made for each 100 cu. yds. (75 cu.m) of concrete, or fraction thereof, but not less than one set of cylinders for each day's concrete placement of each concrete type. Make 5 standard 6x12 (15x30 cm) cylinders and test in accordance with ASTM C31 and C39. Test two cylinders at the age of 7 days and two cylinders at the age of 28 days. Keep one cylinder in reserve for 56-day test if 28 day test does not meet requirements. Only one set of tests shall be made from any one batch of concrete and all 5 cylinders shall be made from the same batch. One 7-day cylinder and one 28-day cylinder shall be cured in a pit at the job site to simulate the same curing conditions as the concrete used in the piles. The remaining cylinders shall be cured in the laboratory. Reports of cylinder tests shall state: The location in the structure; laboratory or site curing; compression strength; type of fracture; age at testing; concrete supplier; mix specification strength and any other pertinent information, together with a statement as to whether this concrete complies with the specifications. In addition, one cylinder for 7-day test shall be taken from every truck load.

2. Slump Tests: ASTM C143. Provide a slump cone at the site at all times. Make two (2) test for each 100 cu. yds. (75 cu.m) of concrete, or fraction thereof, but not less than two (2) tests for each day's placement of each type of concrete. Each test shall be from a separate batch.

3. Inspection of Batch Plant operation as required to ensure that concrete delivered to job complies with the specifications and the design mix. Batch plant inspection shall be required once at start of job and thereafter if concrete falls below specification strength or is not satisfactory to the Inspector of Record.

C. Additional Tests: If, in the opinion of the Architect, based on cylinder strengths below specification requirements or visual defects, concrete of poor quality has been placed, additional tests shall be made as directed by the Architect and at the expense of the Contractor. Tests may be compression tests on cored cylinders, ASTM C42, and/or load tests as outlined in ACI 318, Section 202, or as directed by the Architect. Complete continuous coring of piles will be required, at the Contractor's expense, where observation of the concrete placing operations indicates cause for suspicion of the quality of the concrete, presence of voids, segregation or other possible defects in the piles.

1. Probe the top 2' (60 cm) of fresh concrete at the top of shaft or where concrete placement is delayed to determine consistency. If laitance, foreign matter, or excess water is in evidence, the Contractor shall remove same.

END OF SECTION

SECTION 02710
YARD WORK AND STREET WORK

PART 1 -- GENERAL

*1.1 DESCRIPTION

A. Provide all yard and street work indicated on the Drawings and in other Sections of the Project Manual; including but not limited to:

1. Asphalt concrete paving.

2. Asphalt concrete paving repairs.

3. Slurry coating.

4. Portland cement concrete paving, sidewalk and driveways.

5. Asphalt topping over existing A.C. paving.

6. Joint sealant and caulking.

7. Street Work: Curbs, gutters, tree guards and gratings.

8. Street paving repairs.

9. Metal guardrails.

B. Related Sections:

1. Documents affecting work of this Section include but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, DIVISION 1 - GENERAL REQUIREMENTS and other Sections of the Project Manual.

2. Contractor's Use of the Premises in Section 01140.

3. Solid Resource Management in Section 01150.

4. Temporary Facilities and Controls in Section 01500.

5. Demolition and removal of existing sidewalk, curbs, gutters, driveways and existing site improvements in Section 02220 - SITE DEMOLITION.

6. Earthwork including excavating, grading and filling and select base materials in Section 02220.

7. Concrete Reinforcement in Section 03200.

8. Concrete work and concrete paving in Section 03300.

*1.2 QUALITY ASSURANCE

A. Labor: Use adequate number of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and Regulations

1. Conform to the applicable latest edition of the Los Angeles City Building Code and Amendments, the Standard Specifications for Public Works Construction (SSPWC), State of California Department of Transportation Standard Specifications, Los Angeles City Bureau of Engineering Brown Book, latest edition and provisions hereinafter specified in the Project Manual.

C. Permits: Submit inspection/acceptance certificates required by the governing authorities and pay for all the required permits, plan check, inspections, and fees. Arrange for and make required inspections and tests.

D. Survey: According to Section 01112 - SUMMARY OF THE WORK. The Contractor shall furnish all surveying necessarily for the work. All work shall conform to the lines, elevations, and grades shown on the drawings. The Contractor shall submit the grade sheets to the City Engineer for review.

1.3 ALTERATIONS, REPAIRS AND REPLACEMENTS

A. As required for complete construction of a project; materials and construction to match existing adjacent work where occur in quality and appearance and conform to applicable provisions of the Project Manual.

B. Maintain vehicular and pedestrian traffic in accordance with W.A.T.C.H. (Work Area Traffic Control Handbook, latest edition)

1.4 PROTECTION

A. Required: Furnish, erect and maintain fences, barriers, lights and signs as necessary, in order to protect the public, City personnel, Contractor's personnel, existing work and work of this Section under this Contract.

B. All existing structures beneath the pavement shall be protected from any operation. No impact tool shall be allowed in the demolition of the existing pavement which may affect the existing structure. All sewerage and storm drain structures, utility vault, etc. extending two (2) inches or more above the new subgrade shall be removed by the Contractor to the new subgrade before paving. Structures projecting less than 2 inches above the subgrade may be paved over and later adjusted to grade.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials, and products and equipment to the job-site where directed by the City Engineer.

B. Storage: Store materials where located on the job-site not interfering with work operations of this Section as directed by the City Engineer and easily accessible when needed to be installed or used.

C. Handling: Handle materials, etc. safely and avoiding damage to such materials prior to installation.

*1.6 SUBMITTALS (As Applicable)

A. General: Comply with provisions of SECTION 01330 - SUBMITTALS of DIVISION 1 - GENERAL REQUIREMENTS of the Project Manual.

B. Concrete:

1. Portland Cement Mill Certificate: Submit to the City Engineer of each load showing conformance with the requirements and applicable Section of the SSPWC or otherwise the Testing Laboratory shall test the cement as per ASTM C150 - SPECIFICATION FOR PORTLAND CEMENT.

2. Design Mix and Curing Methods.

C. Asphaltic Concrete:

1. Submit a mix design for asphaltic concrete prepared by a material laboratory under the direction of a California Registered Engineer.

2. Certificates: Submit certificates signed by the materials producer and the asphalt paving Subcontractor, stating that materials meet or exceed the specified requirements prior to any fabrication. Submit the certified delivery tickets for each truckload of asphaltic material delivered to the job site.

D. Product Data: Submit to the City Engineer the data on all proprietary items, materials, etc. to be used in the work of this Section, as conforming to the specified requirements of this Section.

E. Shop Drawings:

1. Coordinate and submit the complete shop fabrication drawings of all metal guardrails, fencing and gates, and handrail.

2. Submit the joint layouts in concrete pavements.

F. Spreading Schedule: At least five (5) working days prior to commencing work, the Contractor shall submit its spreading schedule to the City Engineer for approval. The schedule shall allow residents on the street to be sealed ample “on street” parking within a reasonable distance from their homes. The Contractor shall notify the residents and businesses of the work and shall post temporary “No Parking” signs.

1.7 RECORD DRAWINGS

A. Required: Clearly mark changes, deletions and/or additions to the work of this Section conforming to provisions of Section 30 - RECORD DRAWINGS AND RECORD PROJECT MANUAL of the GENERAL CONDITIONS of the Project Manual.

1.8 REMOVAL AND CLEAN UP

Remove and recycle all surplus materials, debris and rubbish resulting from work of this Section conforming to provisions of Section 01572 - SOLID RESOURCE MANAGEMENT and Section 01740 - CLEANING of DIVISION 1 - GENERAL REQUIREMENTS of the Project Manual.

PART 2 -- PRODUCTS

*2.1 CONCRETE MATERIALS

A. Furnish concrete material, form work and reinforcing in accordance with applicable requirements specified in the drawings and Section 03300 - CAST-IN-PLACE CONCRETE, Section 03100 - CONCRETE FORM WORK, Section 03200 - REINFORCEMENT, and Section 03345 - CONCRETE FINISHING, respectively.

2.2 ASPHALT CONCRETE MATERIALS

A. In accordance with Section 203-6 - ASPHALT CONCRETE and mix in accordance with Section 203-6.5 - PROPORTIONING of the SSPWC. Unless otherwise specified, reclaimed asphalt pavement (RAP), RAP Bituminous material or mixture shall not be used without City Engineer's approval and payment adjustment.

B. Asphalt: PG64-10-75 Viscosity grades conforming to State of California Department of Transportations, Standard Specifications Section 92-1.02(B).

C. For 4-Inch Thick or less A.C. Paving: Single coarse application, Class C2 –PG64-10-75 with ½ inch maximum size aggregates.

2.3 MISCELLANEOUS MATERIALS

A. Aggregate Base (Select Base): As specified in Section 02310 - EARTHWORK.

B. Soil Sterilant: As specified in Section 02310 - EARTHWORK.

C. Tack Coat/Paint Binder: Grade SS-1h emulsified asphalt at an approximate rate of 0.25 L/m5 to 0.45 L/m5 (0.05 to 0.10-gallon per square yard), conforming to Section 302-5.4 - TACK COAT of the SSPWC.

D. Wood Headers: In accordance with Section 302-5.5 - DISTRIBUTION AND SPREADING of the SSPWC 2" x (full depth) inch size (within 2" inches of the thickness of the pavement) edging with 2" x 4" stakes or as otherwise noted or detailed on the drawings. Construction Heart Grade Redwood (S1S1E).

E. Metal Beam Guardrails: As noted on the Los Angeles City Bureau of Engineering Standard Plan No. S-462, latest edition and Specification of AASHTO, M180.

F. Grout: Non-shrink grout; Embeco by Master Builders, Inc., 8978 Haven Ave. #A, Rancho Cucamonga, CA 91730 (800) 228-3315 or equal.

PART THREE - EXECUTION

3.1 JOB-SITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed.

1. Correct conditions detrimental to timely and proper completion of the work, as directed by the City Engineer.

2. Do not proceed until such detrimental conditions are corrected.

B. Comply with stormwater pollution control measures as indicated in Section 02310 - EARTHWORK of the Project Manual.

*3.2 ASPHALT CONCRETE PAVING

A. Materials: As hereinbefore specified.

B. Subgrade Preparation: Prior to placing the selected base materials, compact the upper 6" of subgrade to 95% relative compaction, as per Section 301-1 - SUBGRADE PREPARATION of SSPWC. Suitably roll subgrade to provide a smooth surface to a tolerance of plus or minus 0.04 ft. in accordance with Section 301-1.2 - PREPARATION OF SUBGRADE of the SSPWC.

C. Select Base: Place the Select Base materials to thickness [indicated on the drawings], in accordance with Section 301-2 - UNTREATED BASE of the SSPWC, after the subgrade preparation is completed.

D. Asphalt Paving Thickness and Courses:

1. Thickness as indicated on the Drawings and as required for “Street Work” repairs below.

E. Construction:

1. General: In accordance with Section 302-5.5 - DISTRIBUTION AND SPREADING of the SSPWC thereto.

2. Prime Coat: Apply to the subgrade or aggregate base prior to placing the asphalt concrete and subbase; and to other surfaces designated by the City Engineer.

3. Tack Coat: Apply to concrete surfaces abutting new A. C. paving at least 24 hours prior to laying new work; apply to the surface of any course before the succeeding course or all cold pavement joints, curbs, gutters, manholes and the like. All the surfaces shall be free of water, foreign material or duct when the tack cold is applied.

4. Laying and Compaction: In accordance with Section 302-5.5 DISTRIBUTION AND SPREADING and Section 302.5.6 - ROLLING of the SSPWC.

   If the asphalt concrete base course is 6" inches or thicker, the Contractor may at its option, construct the base course in one paving operation, in accordance with the Los Angeles City Standard Plan S-610, latest edition and the SSPWC.

5. Finish asphalt concrete surfaces smooth and even, to [indicated elevations] without low spots, hollow or irregularities and properly sloped for drainage.

F. Testing:

1. Upon completion, the pavement shall be true to grade and cross section. When a straight edge is laid on the finished surface, the surface shall not vary from the edge of the straightedge no more than ⅛” inches, except at the intersection or at the change of grade.

2. Flood Tests: In the presence of the Inspector or City Engineer and prior to acceptance of the work, water flood tests by water tank truck. All depressions where water ponds shall not exceed a depth of more than ⅛" fill.

3. Any area that is not within this tolerance shall be brought to grade by removing the paving material in the area to be repaired by an approved. Provide a

minimum laying depth of 1" inches of the new pavement material at the joint line. Repairs shall not be made to the pavement surface by feather edging at the joints.

3.7 "STREET WORK" ASPHALTIC CONCRETE REPAIRS

A. Required: As necessary to accommodate construction of new storm and sewerage pipings, curbs, gutters and driveways as indicated on drawings**;** as necessary due to excavation, trenching and utility connections. Provide a minimum laying depth of 1" inches of the new pavement material at the join line. Repairs shall not be made to pavement surfaces by feather-edging at the joints.

B. Application: Upon completion of all work within existing asphalt concrete paved areas, Contractor shall repair the existing asphalt concrete paving conforming to requirements of the SSPWC and the Los Angeles City Bureau of Engineering standards as follow:

1. Properly remove and repair subgrade, sub-base and aggregate base as approved by the City Engineer or Inspector to match existing adjoining work. Identify the mixture or density of existing adjoining work and submit the proposed mix design to the City Engineer for approval.

2. Soil Sterilization: Apply weed killers (soil sterilant) on areas to be paved with asphalt concrete; soil sterilant to be applied as recommended by the manufacturer; The Contractor shall certify in writing that material has been applied.

3. Tack coat surfaces of existing asphalt concrete surfaces as per 302-5.4 - TACK COAT of the SSPWC over which new materials will be laid of edges of existing saw cut asphalt concrete and/or concrete, and other structures against which new asphalt concrete will be placed, terminate tack coats on concrete surfaces at top of asphalt concrete paving.

4. Lay new asphalt concrete paving conforming to Section 302-5.6.2 - DENSITY AND SMOOTHNESS of the to match adjoining work [using material of a heavier density than the "in-place" adjacent work]. Use hot smoothing iron to obtain inconspicuous, straight and flush joint lines. Properly grade to provide the desired drainage [as indicated on the Drawings]. When a ten-foot straightedge is laid on the finish surface parallel to the centerline of the roadway, the surface shall not vary from the edge of the straightedge more than ⅛” inch, except at intersections or at changes of grade.

3.8 "ON-SITE" ASPHALT CONCRETE PAVING REPAIRS

A. Required: To remove and replace defective asphalt concrete paving, base, holes, cracks and other defects, etc.

Provide a minimum laying depth of 1" inches of the new pavement material at the join line. Repairs shall not be made to the pavement surfaces by feather-edging at the joins.

B. Materials: As hereinbefore specified.

C. Subgrade Preparation:

1. Properly remove all damaged paving and base, compact existing subgrade top 6" to 95% relative compaction in accordance with Section 301-1.3 of the SSPWC.

2. Properly roll subgrade to a smoothness tolerance of plus or minus 0.04 ft.

3. Place select base materials to thickness matching existing adjacent materials in accordance with Section 301-2 - UNTREATED BASE of the SSPWC.

D. Asphalt Concrete Paving Repairs:

1. General: In accordance with Section 302-5 - ASPHALT CONCRETE PAVEMENT of the SSPWC.

2. Tack coat cut surfaces of existing saw-cut asphalt concrete and/or concrete against which new asphalt materials will be placed at least 24 hours prior to laying new asphalt materials. Terminate tack coating on concrete surfaces at level with top of new asphalt concrete paving.

3. Lay asphalt concrete paving materials to thickness matching that of adjacent asphalt concrete surfaces. Make smooth, even and flush with adjacent surfaces without low-spots, hollows or irregularities. Use hot smoothing irons to obtain straight and flush joint lines. Properly grade paving repairs to provide desired drainage as indicated on the Drawing. When a straight edge is laid on the finish surface it shall not vary from the straight edge more than 1/8 inch except at intersections or at changes of grade].

3.9 CONCRETE YARD PAVING, CONCRETE SIDEWALK, CURB AND GUTTER

A. General: In accordance with the requirements in the SSPWC, Section 03300 - CAST-IN-PLACE CONCRETE, and Section 07920 - CAULKING AND SEALANT.

B. Locations: Where indicated on the Drawings.

C. Materials: As hereinbefore specified.

D. Preparation:

1. Concrete shall be removed and disposed off, in accordance with Section 300-1.3 REMOVAL AND DISPOSAL OF THE MATERIALS of the SSPWC.

2. Compact existing subgrade and 4" inches thick base material, in accordance with Section 301-2 - UNTREATED BASE of the SSPWC.

3. Concrete shall be placed on the subbase to the required depth. The surface of concrete shall be floated by [finishing machine method] [transverse float method] and dragged on by burlap.

4. For concrete pavements, construct the longitudinal and transverse construction joints, transverse expansion joints, longitudinal and transverse weakened-plane joints at the locations indicated on the drawings and/or conforming to the SSPWC.

Longitudinal construction joints shall be constructed by plain face method as designated on the drawings and conform to the Los Angeles City Standard Plan, S-430, latest edition, and Section 302-6.5 - JOINTS of the SSPWC.

Transverse expansion joints shall be installed at locations shown on the drawings and/or conforming with the SSPWC. Joint filler material shall have a minimum thickness of 2” inch to the depth equal to the thickness of the pavement and shall be composed of materials, as specified in Section 07920 - CAULKING AND SEALANT and conforming to Section 302-6.5 - JOINTS of the SSPWC.

Weakened plane joints shall be constructed at the locations shown on the drawings and shall be formed by cutting a grove, not exceeding 3” inch, in the pavement with a power driven saw. Transverse joint shall be cut to a minimum depth of 1½” inch or one-fourth of the pavement thickness, whichever is greater.

5. The pavement shall be cured by [approved curing method] conforming to the requirements of Section 03300 - CAST-IN-PLACE CONCRETE and/or Section 201-4.1 - CONCRETE CURING MATERIALS of the SSPWC.

6. Concrete pavement shall be immediately barricaded and protected upon installation, and no vehicular traffic shall be permitted therein until the expiration of at least seven (7) days.

7. Concrete driveway shall be 6" inches thick, and constructed and conform to the Los Angeles City Bureau of Engineering Standard Plan S-440, latest edition.

8. Concrete curb and gutters shall be constructed and conform to the Los Angeles City Bureau of Engineering Standard Plan S-410, latest edition.

3.14 METAL BEAM GUARD RAILS

A. Type: Steel beam (rails sections) supported on [steel] post and parts including backup plates, terminal ends, and return in accordance with the Los Angeles City Bureau of Engineering Standard Plan No. S-462, latest edition and conforming to the specifications of Class A, Type 1 W-Beam Guard railing in AASHTO M180. **The** standard galvanized steel posts and other components including the blocking shall be fabricated from steel complying with the requirements of ASTM Designation A53 – SPECIFICATION FOR PIPE, steel, black and hot-dipped, zinc-coated, welded and seamless unless otherwise specified. Steel Tubing used for blocking shall conform to the requirements of ASTM designation, A501 – SPECIFICATION FOR HOT-FORMED WELDED AND SEAMLESS CARBON STEEL STRUCTURAL TUBING, Grade B.

B. Materials: As hereinbefore specified.

C. Finishes:

1. Rail Sections: Galvanized with aluminum paint with black color diagonal stripes.

2. Steel Posts: Galvanized.

D. Installation: Post spacing shall conform to Los Angeles City Bureau of Engineering Standard Plan (latest edition) and the Contract Drawings. Set rail sections parallel to property line or adjacent building line and finish grade of paving. Fill steel posts with concrete, tool top of posts and foundations to shed water with footing edges flush with adjacent paving.

END OF SECTION

SECTION 02821
CHAIN LINK FENCING AND GATES

PART ONE - GENERAL

*1.1 SUMMARY

A. All permanent chain link fencing and gates indicated on the Contract Drawings, as specified herein and as needed for complete and proper installation.

B. **Related Work Sections:**

1. Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, GENERAL REQUIREMENTS in Division 1 and other Sections of the Project Manual.

2. Earthwork in Section 02310.

3. Concrete Work in Section 03300.

1.2 QUALITY ASSURANCE

A. **Labor:** Use adequate number laborer's who are thoroughly trained and skilled in the fencing trade and who are completely familiar with the specified requirements and methods needed for the proper executions of the work of this Section.

***B.** **Codes and Regulations:** Perform all work in strict accordance with applicable Government Codes and Regulations, meeting all "Safety Standards" of CAL/OSHA, County and the current Los Angeles City-Building Code and applicable Amendments.

C. **Qualification of Fabricators**: Provide adequate number of fabricators who are thoroughly familiar with the specified requirements regarding fabrication of fencing fabrics, posts and gates.

D. **Quality of All Materials and Accessories**: As recommended by the manufacturer, subject to the acceptance by the City Engineer. All materials and accessories shall conform with the requirements of the Standard Specifications for Public Works Construction (SSPWC) and specified herein.

1.3 SUBMITTALS

A. **General:** Comply with applicable provisions of Section 01340 – SUBMITTALS in DIVISION 1 - GENERAL REQUIREMENTS and other Sections of the Project Manual.

***B.** **Product Data:**

1. Manufacturer's list of items proposed to be provided under this Section.

2. Manufacturer's Specifications and other data needed to prove compliance with the specified requirements.

3. Shop drawings in sufficient detail to show layout of fence and gate, elevation details, fabrication, assembly, hardware, installation, anchorages and interface of work of this Section with work of adjacent trades.

4. Manufacturer's recommended installation procedures which when reviewed by the City Engineer or Consultant, will become the basis for accepting or rejecting actual installation procedures used on the Work.

5. Manufacturer's certification of compliance for chain link fabric posts and rails.

1.4 PRODUCT HANDLING

A. **Protection**: Protect fencing fabric, posts and gate assemblies before, during and after installation. Properly package and identify and note location of unassembled items (hardware, etc.) for protection against damage.

B. **Delivery**: Deliver all items to be built into concrete or masonry work in time, so as not to delay construction and installation operations.

C. **Storage**: Store all fencing and gate assemblies where directed by the City Engineer until time for installation.

2.1 MATERIALS

A. **General:** All materials for fencing, posts and gates and fasteners to be new and hot-dipped galvanized.

B. **Galvanizing:** Comply with requirements of Section 210-3 - GALVANIZING of SSPWC, except as modified herein.

C. 1. Fabric: As per ASTM A392 - SPECIFICATION FOR ZINC COATED STEEL CHAIN LINK FENCE FABRIC and A817 - SPECIFICATION FOR METALLIC - COAT STEEL WIRE FOR CHAIN LINK FENCE FABRIC, 2-inch mesh chain link of 9-gage steel wire (minimum 75,000 psi tensile strength) galvanized 1.2 oz/ft^2 zinc in single fabric width for entire height and with top and bottom selvedges twisted and barbed.

2. Fabric Tie: 11 gage galvanized steel used to fasten the fabric to posts, rails and gate frame.

D. **Posts:**

1. Schedule 40 Standard weight pipe conforming to ASTM F-1083 **-** SPECIFICATION FOR PIPE, STEEL, HOT-DIPPED ZINC - COATED (GALVANIZED) WELDED, FOR FENCE STRUCTURES.

2. Line Posts: 2 3/8-inch O.D. complete with malleable iron eye-top of suitable design to provide moisture-proof cap.

3. Terminal (End) and/or Corner Posts: 2 7/8-inch O.D. with malleable iron moisture-proof cap.

4. Gate Posts: 4-inch O.D. complete with malleable iron moisture-proof cap.

E. **Top [and Bottom] Rails:** 1-5/8-inch O.D. standard weight steel pipe complete with end caps and end clamps for attachment to posts.

F. **Horizontal and Diagonal Bracing:**

1. Horizontal Rails with Diagonal Bracing to end Sections: Intermediate horizontal

rail, 1-5/8-inch O.D. standard weight steel pipe complete with end caps and clamps for attachment to posts.

2. Diagonal: 3/8-inch diameter steel truss rods complete with turn buckles and attachments to post.

G. **Tension Wire:** No. 7-gage galvanized coiled spring steel wire for fabric lighter than 9-gage; for fabric of 9-gage and heavier use 6-gage galvanized coiled spring steel wire.

H. **Extension Arms for Barbed Wire:** 45-degree angle of pressed steel with provisions for anchorage to top of posts and anchorage of 3 rows of barbed wire, 5-inch centers, thereto; and which shall also act as a weather cap and allow for passage of top rail.

I. **Barbed Wire (as necessary for special security):** 12 ½- gage, two-strand galvanized steel wire, with 14-gage, 4-point pattern barbs spaced approximately 5-inches on center as per ASTM A-121 - SPECIFICATION FOR ZINC (HOT-DIP GALVANIZED) COATINGS ON IRON AND STEEL PRODUCTS, Class 3.

J. **Galvanizing Repair Material:** Hot repair compound conforming to Federal Specification O-G-93, "Galvalloy" by Metalloy Products Co., Los Angeles, California or "Re-Galv" by Galvweld applied as recommended by the manufacturer.

K. **Galvanized Steel Brace Bands, Tension Bands or Bars and Tension Rods**: Brace bands shall be galvanized**,** minimum of 3/16 inch x 3/4-inch wide; tension bands or bars shall be 3/16 inch x 3/4-inch wide and tension rods shall be 3/8 inch diameter galvanized steel rod with galvanized turnbuckles or other suitable tightener or tightening devices.

L. **Non-Shrink Grout:** An approved non-shrinking premixed material; **[**Embecco, manufactured by Master Builders Inc., 8978 Haven Ave., # A, Rancho Cucamonga, CA 91730, (800) 228-3318,**]** or equal.

2.2 GATE HARDWARE

A. **Swinging Gate:**

1. Hinges: Heavy-duty ball and socket, industrial service*,* offset type*,* minimum 3 inch in width.

2. Latch for Single Swing Gate: Heavy malleable iron, fork type with provisions for padlocking.

2.3 GATE CONSTRUCTION

A. **Sliding Gate Frame Construction:**

1. All welded, fabricated of 1 7/8-inch O.D., galvanized steel pipe; all welded joints ground smooth and coated with a galvanizing repair material; all in accordance with reviewed Shop Drawings.

2. Frame Bracing: Use galvanized steel truss rods with galvanized turn buckles as hereinbefore specified.

3. Fabric: Same as hereinbefore specified for fencing, placed on exterior side of gate frame, as indicated, in same manner as specified for fencing.

PART THREE - EXECUTION

3.1 SURFACE CONDITIONS

Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until detrimental conditions are corrected.

3.2 CHAIN LINK FENCE INSTALLATION

A. **General:** By manufacturer, or his authorized representative, in accordance with manufacturer's specifications and best practice.

B. **Post Setting:** In concrete foundations or in preformed holes in walls; minimum 36 inches depth and 12 inch diameter foundation as indicated for gate post; minimum 30 inches depth and 12 inches diameter foundation as indicated for line posts; minimum 24 3/8 inches diameter x 12 inches deep performed hole and minimum 5 7/8 inches diameter x 12 inches deep performed hole in wall as indicated for the line post and end/corner posts, respectively; set plumb, at proper height and spacing in straight alignment for uniform installation as indicated on the Drawings.

1. Excavating and Backfilling: Neatly and accurately excavate foundation holes for posts as indicated. Compact subgrade or any loose material. Solidly and firmly backfill around completed concrete foundations with excavated earth materials to finish grade or to proper elevation, as necessary for required paving as applicable.

2. Concrete Foundation: Standard 3250 psi concrete conforming to the current Los Angeles City Building Code and applicable Amendments; finish top of foundation smooth and even, sloped to shed water and with edges at finish grade of adjoining ground or paved surfaces. Allow concrete to attain at least 75% of its 28-day strength before installation of fencing components.

3. Secure line and end/corner posts set in specified diameter preformed hole with minimum one (1) inch of an approved non-shrink type grout cover all around. Top of grout shall be □ inch above the wall surface and shaped or sloped to drain water away from the post.

C. **Top Rail:** Extend through post eye-top caps and attach ends to corner, gate, and/or terminal (end) posts.

D. **Horizontal and Diagonal Bracing:**

1. Horizontal Rail: Locate mid-height in fencing panels adjacent to gates, corner, and terminal (end) posts.

2. Diagonal Bracing: Extend from the joint of horizontal brace (with adjacent post) diagonally to the base of gate, corner, or terminal post.

E. **Fabric:**

1. Install tension wire at bottom fabric before stretching fabric or attach to each post with ties. The fabric shall be installed so that the top edge projects over the top

rail of the fence and the bottom tension wire or bottom rail by 3 inches. The bottom of the fabric shall extend to within 2 inches of the natural ground or final grade. High points of ground shall be excavated to clear the bottom of the fabric and depression shall be filled and compacted to within 2 inches of the bottom of fabric. Secure fabric to tension wire with galvanized clip rings or wire ties spaced not more than 18 inches apart.

2. Tightly stretch and secure to line posts, with adequate tie wires, space maximum 18-inches apart or as recommended by manufacturer.

3. Secure fabric to top rail, terminal (end) and gate posts by means of heavy, galvanized steel bands bolted to 1/4-inch x 3/4-inch tension bars passing vertically through full height of fabric 16 inches interval.

3.3 SWINGING GATE INSTALLATION

Properly hang or set gate(s) in plumb and level position for full opening without interference and adjust the hardware for smooth and trouble-free operation; complete with heavy center drop and cane bolt, hold-back sleeves properly located and concreted in place as indicated on the drawings. Concrete foundation for sleeve shall be domed or sloped at top to shed water and with edges at finish grade or adjoining ground or paved surfaces.

3.4 MISCELLANEOUS

A. Use U-shaped tie wires, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.

B. Bend ends of wire to minimize hazards to persons and clothing.

C. **Fasteners:**

1. Install galvanized nuts for tension band and hardware bolts on side of fence opposite fabric side.

2. Peen the ends of bolts to prevent removal of the nuts.

D. **Repairs:** Repair fencing coatings damaged in the shop or during field erection using a hot-applied repair compound applied in accordance with repair compound manufacturer's recommendations as approved by the City Engineer; at no added cost to the City.

E. **Cleanup**: Comply with provisions of Section 01710 - CLEANING of the GENERAL REQUIREMENTS regarding removal from the job-site; rubbish, all equipment, unused materials, temporary structures and/or facilities no longer required.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish all materials for concrete formwork, bracing, shoring, and supports and shall design and construct all falsework and scaffolding, all in accordance with the provisions of the Contract Documents.

B. DEFINITIONS

1. Exposed Concrete: All concrete that is visible in the finished work, including concrete to be painted.

2. Unexposed Concrete: All other concrete that is concealed in the finished work, including plastered surfaces and attic and utility spaces.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02220 Earthwork.

B. Section 03200 Reinforcement Steel.

C. Section 03290 Joints in Concrete.

D. Section 03310 Cast-in-Place Concrete.

E. Section 03315 Grout.

F. Section 03370 Concrete Curing.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference standards and Standard Specifications as specified in the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards, as applicable:

1. <u>Government Standards:</u>

PS 1	U.S. Product Standard for Concrete Forms, Class I
PS 20	American Lumber Softwood Standard
CSS	Caltrans Standard Specifications

2. <u>Commercial Standards:</u>

ACI 347	Recommended Practice for Concrete Formwork
ACI 117	Standard Tolerances for Concrete Construction and Materials

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. Falsework Calculations and Drawings: The CONTRACTOR shall comply with all the latest applicable Sections of the Division of Industrial Safety, Construction Safety Orders. In addition, formwork/falsework must be designed, fabricated, erected, supported, braced, and maintained so that it will be capable of supporting without failure all vertical and lateral loads that might be applied to the formwork. Drawings and plans, including all revisions for the jack layout, formwork (including shoring equipment), working decks, and scaffolds, must be available at the jobsite. All shoring equipment (including equipment used in reshoring operations) must be inspected prior to erection to determine that the equipment meets the requirements specified in the formwork drawings. Plans and Calculations shall be prepared and signed by a Civil Engineer, registered in the State of California. A copy of the falsework plan or shoring layout shall be available on the job site at all times. The Engineer who designed the falsework or vertical shoring shall personally inspect such work and provide a written certification that the work conforms to the design.

   Scaffolding Calculations and Drawings: Scaffolding shall be defined in accordance with and shall conform to the Construction Safety Orders of the Division of Industrial Safety. If scaffolding is constructed for this project over or adjacent to traffic, or suspended from the traveled way, the Contractor shall submit to the Engineer working drawings for scaffolding systems. The scaffolding manufacturer's name, address, and phone number shall be shown on the working drawings. The working drawings, details and calculations for the scaffolding shall be stamped and signed by an engineer who is registered as a Civil Engineer in the State of California. In addition, prior to submitting the working drawings to the Engineer, the working drawings shall be stamped and signed by an independent reviewer who is registered as a Civil Engineer in the State of California. The independent reviewer shall not be employed by the same entity preparing the working drawings.

2. The CONTRACTOR shall, in accordance with the requirements in GENERAL REQUIREMENTS file with the City detailed plans of the falsework and scaffolding proposed to be used. Such plans and calculations shall be in sufficient detail to indicate the general layout, pattern layout, dimensioned to precisely locate grooves, form panel jointing, and similar features. The submittal shall also include sizes of members, anticipated stresses, grade of materials to be used, and typical soil conditions.

   a. Form Release Compound

   b. Form Ties and Spreaders

   c. Installation Instructions

1.5 QUALITY ASSURANCE

A. Tolerances: The variation from established grade or lines shall not exceed 1/4-inch in 10 feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances specified in ACI 117, unless noted otherwise.

B. Laborers: Use adequate number of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

C. Prior to construction of formwork for concrete beams and slabs above grade, Contractor shall conduct a meeting at the site to determine and define all cambers required for the project. ENGINEER, Contractor and Contractor's formwork installer shall be in attendance at this meeting.

D. Engage a licensed surveyor to verify that work is within specified tolerances. Surveyor shall report in writing to the ENGINEER, with copy to Contractor, certifying work as acceptable or indicating deviations from allowable tolerances.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials for forms in timely manner to ensure uninterrupted progress.

B. Store materials by methods that prevent damage and permit ready access for inspection and identification.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Except as otherwise expressly accepted by the ENGINEER, all lumber brought on the job site for use as forms, shoring, or bracing shall be new material. All forms shall be smooth surface forms and shall be of the following materials:

Walls	-	Steel or plywood panel
Columns	-	Steel, plywood or fiber glass
Roof, floor, deck and soffit	-	Plywood, Steel Panels
All other work	-	Steel panels, plywood or tongue and groove lumber

2.2 FORM AND FALSEWORK MATERIALS

A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:

1. Lumber shall be Douglas Fir or Southern Pine, construction grade or better, in conformance with U.S. Product Standard PS20.

2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Pine plywood manufactured especially for concrete formwork and shall conform to the requirements of PS 1 for Concrete Forms, Class I, and shall be edge sealed.

3. Form materials shall be metal, wood, plywood, or other material approved by the ENGINEER that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results.

   Forms for exposed exterior concrete surfaces shall be American Plywood Association (APA) High Density Overlay (HDO) Plyform Class I Ext. 48" X 96" X 3/4" minimum thickness.

   Forms for other concrete surfaces shall be American Plywood Association (APA) Douglas Fir B-B Plyform Class I Exterior PS 1, 3/4-inch minimum thickness.

4. Coated Form Plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent equal to “Noxcrete”.

5. Tube forms: Sonoco “Seamless Sonotubes”, Alton Building Products “Sleek Seamless Standard Wall”, or equal, type leaving no marks in concrete, 1-piece lengths for full required height.

B. Unless otherwise shown, exterior corners in exposed concrete members shall be provided with 3/4-inch chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown.

C. Forms and falsework to support the roof and elevated floor slabs shall be designed for the total dead load, and a minimum construction live load of 30 psf .

D. Forms proposed for use at bridges shall comply with Caltrans Standard Specification Section 51.

2.3 FORM TIES

A. Form ties with integral waterstops shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2-inches; and all such fasteners shall be such as to leave holes of regular shape for reaming.

B. Form ties for water-retaining structures shall have integral waterstops. Removable taper ties may be used except for water bearing structures, when approved by the ENGINEER. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

2.4. FORM RELEASE COMPOUND

A. Form release compound shall be non-staining clear coating free from oil, silicone, wax, and not grain-raising, Use “Nox-crete Form coating” by Nox Crete, “Formshield” by Euclid Chemical Company, “Burke Bio Release” by Edoco, or “Cast-Off” by Sonneborn, or an approved equal. Where form liners are used, provide form compound recommended by form liner manufacturer. However, regardless of product use, provide form compound that is VOC compliant for the area used.

2.5 EARTH FORMS

Unless otherwise indicated or required, concrete for footings and pile caps may be placed directly against vertical excavated surfaces, provided the material will stand without caving, that minimum reinforcing steel clearances are maintained, and suitable provisions are taken to prevent raveling of top edges or sloughing of loose material from walls of excavation. Sides of excavation shall be made with a neat cut and the width made as indicated. Concrete which is exposed to view on exterior shall be formed to maintained depth of 6 inches below finished grade.

PART 3 -- EXECUTION

3.1 GENERAL

A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the WORK and replaced at the CONTRACTOR's expense. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of

concrete forms, falsework, and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be properly installed before concrete placement and shall be maintained during placement. Such lines shall be used by CONTRACTOR's personnel and by the INSPECTOR and shall be in sufficient number and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.

B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

C. Camber: Place suitable jacks, wedges, or similar means to induce camber and to correct settlement in forms before and during concrete placing. Camber shall be as determined in pre-installation meeting specified above. In general, formwork shall be capable of accommodating camber of 1/8" per 10' of span plus 1/4".

3.2 FORM DESIGN

A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 3/4-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement and fines during placing and vibrating of the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and paste during placement and vibration of concrete. Such gasket may be a 1- to 1-1/2-inch diameter polyethylene rod held in position to the underside of the wall form. Adequate clean-out holes shall be provided at the bottom of each lift of forms. The size, number, and location of such clean-outs shall be as acceptable to the INSPECTOR.

B. Actual form design shall conform to ACI 347.

C. For concrete mixes characterized as self-consolidating concrete, high performance concrete, or known to contain components that can potentially extend the plastic state of the concrete, the forms shall be designed to sustain the resulting hydrostatic pressure for the total pour height or pressure head for that day of pour, whichever is more. For such mixes, appropriate set-time tests shall be conducted in preparation of the mix design and this information made available to the form designer.

D. Forms proposed for use at bridges shall comply with Caltrans Standard Specification Section 51-1.

3.3 CONSTRUCTION

A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1-inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the ENGINEER. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts and other features as required. Fill form joints to produce smooth surfaces, intersections, and arrises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.

D. Set embedded piping and rough hardware in forms to be embedded in concrete in a manner so that the required strength of the structure will not be reduced.

E. Apply form release compound on formwork in accordance with manufacturer's instructions prior to placing of reinforcing steel, anchorages, and embedded items.

F. Construct forms suitable for removal without hammering or prying against and damaging the concrete.

G. Openings in Forms: Provide as required to facilitate cleaning and inspection. Close such openings immediately after cleaning and before placement of concrete. Provide air relief holes in formed top surfaces of concrete elements as required.

H. Form Ties:

1. Embedded Ties: Holes left by the removal of form tie cones shall be clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section 03310, "Cast-in-Place Concrete". Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.

2. Removable Ties: Where taper ties are approved for use in non water bearing structures, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2-inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

I. Coordination:

1. Provide slots, openings, chases, recesses, grounds, nailers and screeds required by other trades and subsequent work.

2. Ensure that conduit, pipes, sleeves, anchors, hangers and ties are secured in forms before concrete is placed.

3.4 REUSE OF FORMS

Forms may be reused only if in good condition and only if acceptable to the INSPECTOR. Light

sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the INSPECTOR.

3.5 REMOVAL OF FORMS

Careful procedures for the removal of forms shall be strictly followed, and this work shall be done with care so as to avoid damage the concrete. No heavy loading on green concrete will be permitted. The period of time for formwork removal shall be in accordance with ACI 318, Chapter 6 and Section 303-1.4 of Standard Specifications and as follows:

1. Do not remove formwork until concrete has attained sufficient strength to support its own weight and all superimposed loads including construction loads and to permit form and falsework removal with complete safety.

2. In the case of concrete members subject to bending stresses, where the member relies upon forms for vertical support, forms shall remain in place until test cylinders attain a minimum comprehensive strength of 75 percent of the 28-day strength specified in Section 03310, "Cast in-Place Concrete", provided, that no forms shall be disturbed or removed under individual panel or unit before the concrete in the adjacent panel or unit has attained 75 percent of the specified 28-day strength and has been in place for a minimum of 7 days.

3. Forms for roofs and elevated slabs shall remain in place a minimum of 10 days after concrete has been placed.

4. Forms for all vertical walls and columns shall remain in place at least 3 days after the concrete has been placed.

5. Formwork removal shall also be subject to the curing requirements of section 3370 of these specifications and as authorized by the ENGINEER.

6. Reshore structural members as specified below because of design requirements or construction conditions to permit successive construction.

The time required to establish said strength shall be determined by the ENGINEER based on test cylinders made for this purpose from the concrete placed and in accordance with ACI 318 and the curing requirements of section 3300 & 3370. If the time so determined is more than the minimum time specified above, then that time shall be used as the minimum length of time. Forms for all parts of the WORK not specifically mentioned herein shall remain in place for periods of time as determined by the ENGINEER.

3.6 FORMWORK TOLERANCES

A. Deflection: Limit deflection of forming surfaces from concrete pressure to L/240.

B. Finish Lines: Position formwork to maintain hardened concrete finish lines within following permissible deviations.

1. Variation from Plumb:

In 10'-0"	1/4” max.
In any story or 20'-0"	3/8” max.
In 40'-0" or more	3/4” max.

2. Variation from Level or Grades Indicated

In 10'-0"	1/4” max.
In any bay or 20'-0" maximum	3/8”
In 40'-0" or more	3/4” max.

C. Building Lines: Variation of linear building lines from established position in plan and related position of columns, walls and partitions:

1. In any bay or 10'-0" maximum	1/2”
2. In 40'-0" or more	1”

D. Slab Openings: Variations in size and location of sleeves and slab openings shall not exceed 1/4”.

3.7 MAINTENANCE OF FORMS

Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a nonstaining mineral oil or other lubricant acceptable to the ENGINEER. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the CONTRACTOR shall perform the oiling at least two weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

3.8 FALSEWORK

A. The CONTRACTOR shall be responsible for the design, engineering, construction, maintenance, and safety of all falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, the requirements of the Construction Safety Orders of the California Division of Industrial Safety, and the requirements specified herein.

B. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.

C. Falsework shall be placed upon a solid footing, safe against undermining, and protected from softening. When the falsework is supported on timber piles, the maximum calculated pile loading shall not exceed 20 tons. When falsework is supported on any portion of the structure which is

already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

D. Reshoring:

1. Minimum reshoring with falsework shall consist of not less than half the full required falsework added under the last placed floor over which full falsework is to be placed for the next floor above. Leave reshoring in place for at least 10 days after the floor above is placed, but in no case remove falsework until the next concrete placing has attained a compressive strength equal to 75% of that required for the 28 days age as determined by controlled test cylinders.

2. Maintain a form and falsework removal record.

E. Falsework proposed for use at bridges shall comply with Caltrans Standard Specification Section 51.

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SECTION 03200
REINFORCEMENT STEEL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish, fabricate, and place all concrete reinforcement steel, welded wire fabric, couplers, and concrete inserts for use in reinforced concrete and masonry construction and shall perform all appurtenant work, including all the wires, clips, supports, chairs, spacers, and other accessories, all in accordance with the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 Concrete Formwork.

B. Section 03290 Joints in Concrete.

C. Section 03300 Cast-in-Place Concrete.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference standards of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards, as applicable:

Commercial Standards:

ACI 315	Details and Detailing of Concrete Reinforcement.
ACI 318	Building Code Requirements for Reinforced Concrete.
ACI 350	Code Requirements for Environmental Engineering Concrete Structures.
ACI 530	Building Code Requirements & Specifications for Masonry Structures
WRI	Manual of Standard Practice for Welded Wire Fabric
AWS D1.4	Structural Welding Code - Reinforcing Steel
ASTM A185	Specification for Welded Steel Wire Fabric For Concrete Reinforcement.
ASTM A497	Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
ASTM A615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM A706	Low-alloy Deformed Steel Bars for Concrete Reinforcement
ASTM A775	Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884	Specification for Epoxy-Coated Steel Wire Reinforcement

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

2. Government Standards:

CSS	Caltrans Standard Specifications
GWP	Global Warming Potential (maximum acceptable carbon emission limits, established by the California Department of General Services)

1.4 CONTRACTOR SUBMITTALS

A. Submittal shall be made in accordance with the GENERAL REQUIREMENTS (GR).

B. Buy Clean California Act.

a. For project specifications that include GR Section 1601, Buy Clean California Act, bidders shall submit current Environmental Product Declarations (EPDs) for each type of reinforcing steel material (A615, A706) from the originating mill used in the project as well as corresponding mill certifications. When material comes from different mills, an EPD and mill certification will be required for each mill from which the material has been obtained.

b. An EPD must conform to the following:

1) Shall be facility-specific manufacturer/mill EPD.
2) Be independently verified in accordance with ISO 14025 (Type III).
3) Be developed according to the guidelines of the applicable Product Category Rule (PCR), as identified by the Department of General Services, State of California.
4) Have a valid date that has not expired.
5) Shall not exceed the Global Warming Potential (GWP) limit as required by GR Section 1601.

c. EPD shall be submitted concurrently with the product's submittal for review and approval.

d. Specified epoxy-coated or other specified coated reinforcing steel are exempt from having an associated EPD.

C. The following submittals and specific information shall be provided.

1. The CONTRACTOR shall furnish Bill of Materials for rebar, including separate total weights in pounds for plain and epoxy coated reinforcing steel, as well as shop bending diagrams, placing lists, splice lengths and location, and drawings of all reinforcement steel prior to fabrication in accordance with GENERAL REQUIREMENTS, **(**only if the reinforcing details differ from that shown on the plans**)**.

2. Details of the concrete reinforcement steel and concrete inserts shall be submitted by the CONTRACTOR at the earliest possible date after receipt by the CONTRACTOR of the Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements specified and shown. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams which clearly indicate the dimensions of each bar splice.

3. Where mechanical couplers are required or permitted to splice reinforcement steel, the CONTRACTOR shall submit Los Angeles City Department of Building and Safety (LADBS) Research Report approval and manufacturer's literature which contains instructions and recommendations for installation for each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how it is to be installed in the formwork.

4. If reinforcement steel is required or permitted to be spliced by welding at any location, the CONTRACTOR shall submit mill test reports which shall contain the information necessary for the determination of the carbon equivalent as specified in AWS D1.4. The CONTRACTOR shall submit a written welding procedure for each type of weld for each size of bar which is to be spliced by welding; merely a statement that AWS procedures will be followed is not acceptable.

1.5 QUALITY ASSURANCE

A. All reinforcing steel fabrication shall be performed in a LADBS licensed fabricator shop for rebar.

B. The CONTRACTOR shall make provisions for sampling reinforcing steel delivered to the job site. Two sampling bars, cut from different bars and 3 feet in length for bar sizes # 3 through # 5 and 5 feet in length for bars sizes # 6 and larger, shall be taken from each 10 tons or fraction thereof, of each size and heat number delivered to the job site. When the name of the manufacturer, heat identification number, or chemical analysis is not known, the sampling interval shall be each 2.5 tons or fraction thereof, of each bar size and heat number. Tests shall consist of 2 bent tests and 2 tensile tests. Costs of initial tests will be paid by the CITY. Additional tests due to material failing initial tests shall be paid by the CONTRACTOR.

C. If reinforcement steel is welded at any location, the CONTRACTOR shall submit certifications of procedure qualifications for each welding procedure used and certification of welder qualifications, for each welding procedure, and for each welder performing the work. Such certification and qualifications shall be as required by the Los Angeles Department of Building and Safety.

D. The CONTRACTOR shall provide samples of each type of weld used in the work in a quantity and of dimensions adequate for testing. At the discretion of the INSPECTOR, radiographic testing of direct butt welds will be performed. The CONTRACTOR shall provide assistance necessary to facilitate testing. The CONTRACTOR shall repair any weld which fails to meet the requirements of AWS D1.4. The costs of testing will be paid by the CITY; except, the costs of all tests which fail to meet specified requirements shall be paid by the CONTRACTOR.

E. The CONTRACTOR shall provide to the INSPECTOR written identification of reinforcement steel by manufacturer's heat number and mil certification, and the fabricator's release number and type from the point of fabrication to the place of final incorporation of the rebar into the work.

1.6 MARKING AND SHIPPING

A. Tag bundled bars with identification, and transport and store so as not to damage any material. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken.

PART 2 -- PRODUCTS

2.1 REINFORCEMENT STEEL

A. All reinforcement steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A615, Grade 60 Billet Steel Reinforcement with supplementary requirement S-1, and ASTM A706 for rebars subject to welding, or as otherwise shown.

2. Bar reinforcement for wall boundary elements, special moment frames, or when subject to welding, shall conform to ASTM A706, unless noted otherwise.

3. Welded wire fabric reinforcement shall conform to the requirements of ASTM A185 , or ASTM A497 and the details shown; provided, that welded wire fabric with longitudinal wire of W9.5 size wire shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W9.5 size shall be furnished in flat sheets only.

4. Spiral reinforcement may be cold-drawn steel wire conforming to the requirements of ASTM A82, when approved by the ENGINEER.

5. All reinforcements shall be shop fabricated. Bending of reinforcing in the field will not be allowed.

6. Epoxy coated reinforcing steel shall conform to the requirements of ASTM A775 and A884, and shall be used where indicated on the drawing.

7. Reinforcement with any of the following defects will not be acceptable and be immediately removed from the site:

    a. Bar lengths, depths, and/or bends exceeding the specified fabrication tolerances.

    b. Bends or kinks not shown on the Drawings

    c. Bars with reduced cross-section due to excessive rusting or other cause.

B. Accessories:

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Slab bolsters shall have gray plastic-coated legs.

2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Where the concrete blocks are used on concrete surfaces exposed to view, the color and texture of the concrete blocks shall match that required for the finished surface. Wire ties shall be embedded in concrete block bar supports.

3. Use bar supports complying with CRSI recommendations, unless otherwise shown on the Contract Drawings.

4. Do not use wood, brick, or other non-complying material.

5. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

6. For exposed-to-view completed concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic-protected legs. CONTRACTOR's selection subject to the ENGINEER's approval.

2.2 MECHANICAL COUPLERS

A. Mechanical couplers shall comply with the applicable Department of Building and Safety's Research Report. Location of the Mechanical Couplers shall be approved by the ENGINEER. The couplers shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice. CONTRACTOR to provide the required number of couplers and bars for testing in accordance with the Report

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Clearance and coverage requirements shall be maintained at all times.

D. Couplers which are located at a joint face shall be a type which can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. After the concrete is placed, couplers intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs which have an O-ring seal.

E. Hot-forged sleeve-type couplers shall not be used.

2.3 WELDED SPLICES

A. Welded splices shall be provided where shown and where approved by the ENGINEER. All welded splices of reinforcement steel shall develop a tensile strength which exceeds 125 percent of the yield strength of the reinforcement bars which are connected. Provide two samples of each bar size for testing. When welding is to be done in the field, provide field prepared samples. Preparation shall be made by welder actually preparing the production run.

B. All materials required to conform the welded splices to the requirements of AWS D1.4 shall be provided.

C. All welding shall be performed by City of Los Angeles certified welders. All shop welding shall be performed at shops of a City of Los Angeles approved fabricator.

PART 3 -- EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric, couplers, and accessories shall be fabricated, and placed in accordance with the requirements of the City of Los Angeles Building Code, CRSI Recommended Practices and Manual, and WRI, and the supplementary requirements specified herein.

3.2 FABRICATION

A. General: Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318 or ACI 350

(as applicable), except as modified by the Drawings. Bars shall be bent cold.

B. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be prepared by the CONTRACTOR as specified under GENERAL REQUIREMENTS.

C. Fabricating Tolerances: Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length: ± 1 inch

2. Depth of truss bars: + 0, - 1/2 inch

3. Stirrups, ties, and spirals: ± 1/2 inch

4. All other bends: ± 1 inch

3.3 PLACING

A. Placing: Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported using approved accessories and chairs which are strong and rigid enough to prevent any displacement of the reinforcement steel and shall comply with the applicable Department of Building and Safety's Research Report. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. Use care not to damage vapor barriers where they occur.

B. The portions of all accessories in contact with the formwork shall be made of concrete, plastic, or steel coated with a 1/8-inch minimum thickness of plastic which extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Bars additional to those shown which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at its own expense.

E. Placing Tolerances: Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the City of Los Angeles Building Code.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars shall be reviewed and accepted by the ENGINEER.

G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters having gray, plastic-coated standard type legs as specified in Paragraph B herein. Slab bolsters shall be spaced not less than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane shown.

H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 3 feet on centers in any direction. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

3.4 SPACING OF BARS

A. Spacing of reinforcement shall comply with ACI 318 requirements.

B. Spacing of bars on bridge structures shall conform to the requirements in CSS Section 52-1.

3.5 SPLICING

A. General: Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice and location shall be as acceptable to the ENGINEER.

B. Splices of Reinforcement: The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318, Section 12.15.1 for a class B splice. Stagger splices in horizontal wall bars at least 48” longitudinal in alternate bars and opposite faces.

C. Laps of welded wire fabric shall be in accordance with the ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

D. Splices in column spiral reinforcement, when necessary, shall be made by welding or by a lap of 1-1/2 turns.

E. Field welding of bars: In accordance with the approved submittal. Continuous inspection required.

F. Mechanical couplers: Install in accordance with the approved submittal.

G. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the ENGINEER. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by the ENGINEER.

H. Splicing of reinforcement on bridge structures shall conform to CSS Section 52-1.

3.6 CLEANING AND PROTECTION

The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned. Bars with reduced cross-section due to excessive rusting or other cause will not be acceptable for use and shall be replaced by the CONTRACTOR at no additional cost to the CITY.

3.7 FIELD QUALITY CONTROL

A. Inspection: Secure inspection and acceptance from INSPECTOR before concrete is placed. Make arrangements in advance for geotechnical inspection of foundations, continuous inspection as required, and/or structural observation by the designated registered design professional prior to concrete placement.

* * * * * *

SECTION 03290
JOINTS IN CONCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall construct all joints and bearing pads in concrete at the locations shown. Joints required in concrete structures are of various types and will be permitted only where shown, unless specifically accepted by the ENGINEER.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 Concrete Formwork.

B. Section 03200 Reinforcement Steel.

C. Section 03300 Cast-in-Place Concrete.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference standards of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards, as applicable:

1. Federal Specifications:

TT-S-0227E(3)	Sealing Compound, elastomeric type, Multi-component for Caulking, Sealing, and Glazing Buildings and Other Structures).

2. U.S. Army Corps of Engineers Specifications:

CRD-C572

3. Other Government Standards:

CSS	Caltrans Standard Specifications.

4. Commercial Standards:

ASTM C 920	Specification for Elastomeric Joint Sealants.
ASTM D 624	Test Method for Rubber Property -- Tear Resistance.
ASTM D 638	Test Method for Tensile Properties of Plastics.
ASTM D 746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
ASTM D 747	Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
ASTM D 1751	Premolded Joint Filler
ASTM D 1752	Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

ASTM D 2240 Test Method for Rubber Property -- Durometer Hardness.

1.4 TYPES OF JOINTS

A. Construction Joints: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a waterstop and sealant groove of the shape specified and as shown on the plans.

B. Contraction Joints: Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint, unless noted otherwise; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and sealant groove shall also be provided.

C. Expansion Joints: To allow the concrete to expand freely, a space is provided between the two pours, the joint shall be formed as shown on the plans. This space is obtained by placing a filler joint material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in water bearing members shall be provided with an approved type waterstop.

Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material. The space so formed shall be filled with a joint sealant material as specified in the Paragraph in Part 2 entitled "Joint Sealant." In order to keep the two elements in line the joint shall be provided with a sleeve-type dowel as shown.

D. Control Joints (Weakened Plane): The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions as shown on the plans, is formed or saw-cut in the concrete and shall be filled with a joint sealant material as specified in the Paragraph in Part 2 entitled "Joint Sealant."

E. All other Joints, bearing devices, and elastomeric bearing pads for bridge structures shall comply with CSS Section 51.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. Waterstops: Prior to use of the material required under this contract, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used. The material sample shall be representative of the material to be furnished under this contract. The balance of the material to be used under this contract shall not be produced until after the ENGINEER has reviewed and approved the qualification samples.

2. Joint Sealant: Prior to ordering the sealant material, the CONTRACTOR shall submit to the ENGINEER for review and approval, data to show compliance with the requirements of the Contract Documents. Certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with the above requirements shall be furnished the ENGINEER before the sealant is used on the job.

3. Shipping Certification: The CONTRACTOR shall provide written certification from the manufacturer as an integral part of the shipping form, to show that all of the material shipped

to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

4. The CONTRACTOR shall submit placement shop drawings showing the location and type of all joints for each structure.

1.5 QUALITY ASSURANCE

A. Waterstop manufacturer shall demonstrate five years (minimum) continuous, successful experience in production of waterstops.

B. Waterstop Inspection: It is required that all waterstop field joints shall be subject to inspection, and no such work shall be scheduled or started without having made prior arrangements with the INSPECTOR to provide for the required inspections. Not less than 24 hours notice shall be provided to the INSPECTOR for scheduling such inspections.

C. All field joints in waterstops shall be free of misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the CONTRACTOR at its own expense.

D. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less.

4. Misalignment of joint which result in misalignment of the waterstop in excess of 1/2-inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.

6. Bubbles or inadequate bonding.

E. Waterstop Samples: Prior to use of the waterstop material in the field, a sample of a fabricated metered cross and a tee constructed of each size or shape of material to be used shall be submitted to the ENGINEER for approval. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this contract. Field samples of fabricated fittings (crosses, tees, etc.) will be selected at random by the INSPECTOR for testing. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

F. Construction Joint Sealant: The CONTRACTOR shall prepare adhesion and cohesion test specimens as specified herein, at intervals of 5 working days while sealants are being installed.

G. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:

1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1/2-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-

inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1/2-inch.

2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall not exceed 24 hours.

3. Following curing period, the gap between blocks shall be widened to one inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

H. Store waterstops under tarps to protect from oil, dirt, and sunlight.

1.6 GUARANTEE

A. The CONTRACTOR shall provide a 5-year written guarantee of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of the CITY, at no additional cost to the CITY, any such defective areas which become evident within said 5-year guarantee period.

PART 2 -- PRODUCTS

2.1 PVC WATERSTOPS

A. General: Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The CONTRACTOR shall obtain from the waterstop manufacturer and shall furnish to the ENGINEER for review, current test reports and a written certification of the manufacturer that the material to be shipped to the job meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein.

B. Flatstrip and Center-Bulb Waterstops: Flatstrip and center-bulb waterstops shall be as detailed and as manufactured by: Kirkhill Rubber Co., Brea, California; Greenstreak, St. Louis, MO, Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; or an approved equal; provided, that at no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8-inch.

C. Multi-Rib Waterstops: Multi-rib waterstops, where required, shall be as detailed and as manufactured by [Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak, St. Louis, MO], or an approved equal. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.

D. Other Types of Waterstops: When other types of waterstops, not listed above are required and shown, they shall be subjected to the same requirements as those listed herein.

E. Waterstop Testing Requirements: When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Std.
Tensile Strength-min (psi)	1750	D 638, Type IV
Ultimate Elongation-min (percent)	350	D 638, Type IV
Low Temp Brittleness-max (degrees F)	-35	D 746
Stiffness in Flexure-min (psi)	400	D 747
Accelerated Extraction (CRD-C572)		

Tensile Strength-min (psi)	1500	D 638, Type IV
Ultimate Elongation-min (percent)	300	D 638, Type IV

Effect of Alkalies (CRD-C572)

Change in Weight (percent)	+0.25/-0.10	------
Change in Durometer, Shore A	+5	D 2240

Finish Waterstop

Tensile Strength-min (psi)	1400	D 638, Type IV
Ultimate Elongation-min (percent)	280	D 638, Type IV

F. Accessories

1. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.

2. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.

3. Provide Teflon coated thermostatically controlled waterstop splicing irons for field butt splices.

2.2 RUBBER WATERSTOPS

For bridge structures, neoprene waterstop requirements shall conform to CSS Section 51-1.

2.3 JOINT SEALANT

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water.

B. Joint sealant material shall meet the following requirements:

Work Life	45 - 90 minutes
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness	30 - 40 Shore "A"
Tensile Strength	250 psi, minimum
Ultimate Elongation	400 percent, minimum
Tear Resistance (Die C ASTM D 624)	75 pounds per inch of thickness, minimum
Color	Light Gray

For bridge structures, additional requirements of CSS Section 51 shall also apply.

C. All polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ASTM C 920 or Federal Specification TT-S-00227 E(3) for 2-part material, as applicable.

2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ASTM C 920 Class B, or Federal Specification TT-S-0027 E(3), Type II.

3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ASTM C 920 Class A, or Federal Specification TT-S-0027 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 25 to 35, shall be used.

4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.

D. All sealants, wherever shown, or required hereunder shall be [Rubbercalk 2101-I or 270 as manufactured by Products Research Company; GS 102 or GS 1102 as manufactured by General Sealants Corp]; or an approved equal. For sanitary structures mastic/sealant material shall be [Ram Nek Sealant by Henry Co.; Sika Flex 1A, Sikadur 51 NS by Sika Corp].

E. Sealants for non-waterstop joints in concrete shall conform to the requirements of Section [07900], "Joint Sealants". Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the ENGINEER.

2.4 PREFORMED JOINT FILLER

A. Preformed joint filler material shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 for Type I, except as otherwise specified herein.

B. Unless otherwise noted, preformed joint filler shall be a non-extruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.

2.5 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.6 BOND BREAKER

A. Bond breaker shall be [Super Bond Breaker as manufactured by Burke Company, San Mateo, California; Hunt Process 225-TU as manufactured by Hunt Process Co., Santa Fe Springs, California; Select Cure CRB as manufactured by Select Products Co., Upland, California]; or an approved equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

0.7 BEARING DEVICES AND ELASTOMERIC BEARING PADS

Bearing devices and elastomeric bearing pads shall comply with CSS Section 51.

PART 3 -- EXECUTION

3.1 GENERAL

A. Unless otherwise shown, waterstops of the type specified herein shall be embedded in the concrete across joints as shown. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. The CONTRACTOR shall take suitable precautions and means to support and protect the waterstops during the progress of the work and shall repair or replace at its own expense any waterstops damaged during the progress of the work. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN WATERSTOPS

A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations and the following requirements:.

1. The material not be damaged by heat sealing.

2. The splices have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.

3. The continuity of the waterstop ribs and of its tubular center axis be maintained.

B. Butt joints of the ends of two identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the CONTRACTOR prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

3.3 JOINT CONSTRUCTION

A. Setting Waterstops:

1. In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support the waterstops during the progress of the WORK and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints

2. In placing flat-strip waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise shown, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.

3. Adequate means shall be provided for anchoring the waterstop in concrete. Waterstops shall be positioned so that they are equally embedded in the concrete on each side of the joint.

4. For bridge structures, waterstops shall conform to CSS Section 51-1.

B. Joint Location:

Construction joints, and other types of joints, shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, subject to the approval of the ENGINEER, unless noted otherwise. Where joints are shown spaced greater than 25 feet apart, additional joints shall be provided to maintain the [25-foot] maximum spacing. The location of all joints, of any type, shall be submitted for acceptance by the ENGINEER.

C. Joint Preparation:

Special care shall be used in preparing concrete surfaces at joints where bonding between two sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03300, "Cast-in-Place Concrete." Except on horizontal wall construction joints, wall to slab joints or where otherwise shown or specified, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as specified herein.

D. Construction Joint Sealant:

1. Construction joints in water-bearing floor slabs, and elsewhere as shown, shall be provided with tapered grooves which will be filled with construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed and filled with the construction joint sealant. The primer used shall be supplied by the same manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant filler shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

2. Sealant application shall be in accordance with the manufacturer's printed instructions. The surfaces of the groove for the sealant shall not be coated. Concrete next to waterstops shall be placed in accordance with the requirements of Section 03310, Cast-in-Place Concrete.

3. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application. All sealant shall cure at least 7 days before the structure is filled with water.

4. All sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations. Before work is commenced, the crew doing the WORK shall be instructed as to the proper method of application by a representative of the sealant manufacturer.

5. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, the CONTRACTOR shall arrange to have the crew doing the WORK carefully instructed as to the proper method of mixing and application by a representative of the sealant manufacturer.
6. Any joint sealant which after the manufacturer's recommended curing time for the job conditions of the WORK hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the specified joint sealant. All costs of such removal, joint treatment, re-sealing, and appurtenant work shall be at the expense of the CONTRACTOR.

3.4 BEARING DEVICES AND ELASTOMERIC BEARING PADS

Bearing devices and elastomeric bearing pads shall comply with CSS Section 51.

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SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.

B. The following types of concrete shall be covered in this Section:

1. Structural Concrete: Concrete to be used in all cases except where noted otherwise in the Contract Documents.

2. Sitework Concrete: Concrete to be used for curbs, gutters, sidewalks, pavements, fence and guard post embedment, and underground duct bank encasement unless otherwise shown.

3. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks and cradles, where the preceding items are detailed on the Drawings as unreinforced. Concrete to be used as protective cover for dowels intended for future connection.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 Concrete Formwork

B. Section 03200 Reinforcement Steel

C. Section 03290 Joints in Concrete

D. Section 03315 Grout

E. Section 03370 Concrete Curing

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference standards and the Standard Specifications of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards, as applicable.

1. Commercial Standards:

ACI 117	Specification for Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete
ACI 305.1	Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 318	Building Code Requirements for Structural Concrete
ACI 347R	Guide to Formwork for Concrete

ACI 350	Code Requirements for Environmental Engineering Concrete Structures
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 40	Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
ASTM C 42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 94	Standard Specification for Ready-Mixed Concrete
ASTM C 109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in Cube Specimens)
ASTM C 117	Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
ASTM C 131	Standard Test Method for Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	Standard Specification for Portland Cement
ASTM C 157	Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C 192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 289	Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
ASTM C 311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete
ASTM C 595	Standard Specification for Blended Hydraulic Cements

ASTM C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C 1116	Standard Specification for Fiber-Reinforced Concrete
ASTM C 1157	Standard Performance Specification for Hydraulic Cement
ASTM C 1240	Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C 1550	Standard Test Method for Flexural Toughness of Fiber Reinforced Concrete (Using Centrally Loaded Round Panel)
ASTM C 1579	Standard Test Method for Evaluating Plastic Shrinkage Cracking of Restrained Fiber Reinforced Concrete (Using a Steel Form Insert)
ASTM C 1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM C 1603	Standard Test Method for Measurement of Solids in Water-Suggest you add as it relates to ASTM C1602
ASTM C 1609	Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading)
ASTM D 2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

2. Government Standards:

CSS	Caltrans Standard Specifications
GWP	Global Warming Potential (maximum acceptable carbon emission limits, established by the California Department of General Services)

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. Mix Designs: Prior to beginning the WORK, the CONTRACTOR shall submit to the ENGINEER, for review, and acceptance, preliminary concrete mix designs for each class and type of concrete specified herein. The mix designs shall be designed by an independent testing laboratory acceptable to the ENGINEER. All costs related to such mix design shall be borne by the CONTRACTOR.

Each concrete mix submittal shall contain the following information, as applicable:

a. Location and purpose of the mix.
b. Slump on which the design is based.
c. Total gallons of water per cubic yard, and the water/cementitious materials ratio (w/cm).
d. Brand, type, composition and quantity of cement.
e. Brand type, composition and quantity of fly ash, slag cement, silica fume.
f. Specific Gravity, source and gradation of each aggregate.
g. Ratio of fine to total aggregate per cubic yard.
h. Weight (surface dry) of each aggregate per cubic yard.
i. Brand, type, and ASTM designation, active chemical ingredients and quantity of each admixture.
j. Copy of the Building and Safety Research Report Approval for each concrete admixture.
k. Air content.
l. Compressive strength based on 7-day and 28-day compression tests, including standard deviation calculations, corroborative data (if applicable), and required average comprehensive strength per ACI 318.
m. Time of initial and final set.
n. Certification stamp and signature by a Civil or Structural engineer registered in the State of California, experienced in concrete mix design.
o. Certificate of Compliance for Cement.
p. Concrete pour sequence.
q. Buy Clean California Act
   1.) For project specifications that include GR Section 1601, Buy Clean California Act, bidders shall submit current Environmental Product Declarations (EPDs) for each concrete mix design, from the originating ready-mix plant used in the project. When material comes from different plants, an EPD will be required for each plant from which the material will be obtained.

   2.) An EPD must conform to the following:
      a) Shall be facility-specific manufacturer/plant EPD.
      b) Be independently verified in accordance with ISO 14025 (Type III).
      c) Be developed according to the guidelines of the applicable Product Category Rule (PCR), as identified by the Department of General Services, State of California.
      d) Have a valid date that has not expired.
      e) Shall not exceed the Global Warming Potential (GWP) as required by GR Section 1601.

   3.) EPD shall be submitted concurrently with each mix submittal for review and approval.

2. Certified Delivery Tickets: Where ready-mix concrete is used, the CONTRACTOR shall provide certified weighmaster delivery tickets at the time of delivery of each load of concrete. Each certificate shall show the public weighmaster's signature, and the total quantities, by weight of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate and added at the batching plant as well as the amount of water allowed to be added at the site for the specific design mix. Each certificate shall, in addition, state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to when the batch was dispatched, when it left the plant, when it arrived at the job, the time that unloading began, and the time that unloading was finished.

3. When a water reducing admixture is to be used, the CONTRACTOR shall furnish mix designs for concrete both with and without the admixture.

4. The CONTRACTOR shall furnish a Certificate of Compliance signed by the supplier identifying the type of fly ash and stating that the fly ash complies with ASTM C 618 and these Specifications, together with all supporting test data prior to the use of the fly ash the sample

represents. The supporting data shall also contain test results confirming that the fly ash in combination with the cement and water to be used meets all strength requirements and is compatible with air-entraining agents and other admixtures.

5. The CONTRACTOR shall submit to the ENGINEER for review the design mix for fly ash concrete together with the design mix for Portland cement (non-fly ash) concrete as specified in this Section.

1.5 QUALITY ASSURANCE

A. Laborers: Use adequate number of skilled laborers who are thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Compliance with Regulations: All materials shall comply with the current rules and regulations of the local air quality management district, with the rules regarding volatile organic compounds, and with FDA rules and regulations for dangerous substances in construction products.

C. Concrete Manufacturer: Furnish concrete from licensed commercial ready-mix concrete plants conforming to ASTM C94 and approved by City of Los Angeles Department of Building and Safety. Requirements herein govern when exceeding ASTM C94.

D. Continuous Inspection: Construct structural concrete exceeding 2,500 psi compressive strength under continuous inspection of DEPUTY INSPECTOR. Obtain inspection and approval of forms and reinforcing by CONTRACTOR's Independent Testing/Inspection Laboratory three (3) working days before placing structural concrete in order to be verified by ENGINEER.

E. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.

F. The cost of all laboratory tests on cement, aggregates, and concrete compressive strength, will be borne by the CITY. However, the CONTRACTOR shall be responsible for all other required tests, and shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications.

G. Concrete for testing shall be supplied by the CONTRACTOR at no cost to the CITY, and the CONTRACTOR shall provide assistance and facilities to the INSPECTOR in obtaining samples, and disposal and cleanup of excess material.

H. Field Compression Tests:

1. Compression test specimens will be taken during construction from the first placement of each concrete mix used and at intervals thereafter as selected by the INSPECTOR to insure continued compliance with these specifications. Each set of test specimens will be a minimum of 4 cylinders.

2. Compression test specimens for concrete shall be made in accordance with ASTM C 31. Specimens shall be 6-inch diameter by 12-inch high cylinders.

3. Compression tests shall be performed in accordance with ASTM C 39. Two 6"x12" test cylinders will be tested at 7 days as necessary and two at 28 days. Any remaining cylinders will be held to verify test results, if needed.

I. Evaluation and acceptance of Compressive Strength Concrete shall be based on the following criteria:

1. Concrete shall be sampled and tested in accordance with the ASTM standards stated in Subsection 1.3.B.1.

2. Acceptance of concrete placed shall be based on 28-day compressive strength test results. A 28-day compressive strength test shall consist of the average compressive strength of two 6”x12” concrete test cylinders fabricated from a single load of fresh concrete except that, if a cylinder should show evidence of improper handling, molding, or testing, said cylinder shall be discarded and the compressive strength test shall then consist of the remaining cylinder.

3. Concrete compressive strength tests representing concrete poured-in-place, shall attain the 28-day compressive strength specified in the specifications or as shown on the plans.

4. In-place concrete represented by a compressive cylinder strength test failing to meet the specified 28-day compressive strength shall be removed from the work at no cost to the CITY. Also, the CONTRACTOR shall at its own expense make any corrective changes in the mix deemed necessary by the ENGINEER. The changes in the mix proportions or placement procedures shall be approved by the ENGINEER prior to the placement of any additional concrete subsequent to a failing compressive strength test.

5. As an alternative to the removal of concrete represented by a failed cylinder compressive strength test and subject to the approval of the ENGINEER, the concrete represented by the failed compressive strength cylinder test or tests may be cored in place. The corings shall be completed no later than 10 days from notification of failure by the ENGINEER. The cores shall be taken by the CONTRACTOR in the presence of the INSPECTOR and tested at the CONTRACTOR's expense in accordance with ASTM C 42 by a certified laboratory acceptable to the INSPECTOR. The cores shall be 4 inch diameter (min.) unless otherwise directed by the ENGINEER. At least three cores shall be taken in each area represented by a failed 28-day concrete compressive strength cylinder test. Unless otherwise directed by the ENGINEER, the cores shall be tested wet following a 40-hour submergence. If each core tests at least 85 percent of the specified 28-day compressive strength or greater, the concrete represented may be accepted provided the CONTRACTOR accepts the payment provisions stated below. Concrete represented by failing core tests shall not be paid for and shall be removed by the CONTRACTOR from the work at no cost to the CITY.

6. Payment to the CONTRACTOR for concrete accepted by the ENGINEER based on core test results but represented by failing compressive cylinder test results shall be reduced as follows:

    a. When the result of a single compressive cylinder strength test is less than the specified 28-day compressive strength but 95 percent or more of the 28-day compressive strength, the CONTRACTOR shall pay the CITY **$15** per cubic yard for each in-place cubic yard of concrete represented by the deficient compressive strength cylinder test as determined by the actual sampling interval; and.

    b. When the result of a single compressive strength cylinder test is less than 95 percent of the specified 28-day compressive strength but is acceptable based on core test results taken in accordance with Subsection 1.5.I.5, the CONTRACTOR shall pay the CITY **$20** per cubic yard for each in-place cubic yard of concrete represented by the deficient compressive strength cylinder test as determined by the actual sampling interval.

J. Shrinkage Tests:

1. Drying shrinkage tests shall be provided by the CONTRACTOR for the trial batch specified in the Paragraph in Part 2 entitled "Trial Batch and Laboratory Tests," and during construction to insure continued compliance with these Specifications.

2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157 modified as follows: specimens shall be removed from molds at an age of 23 ±1 hours after trial batching, shall be placed immediately in water at 70 degrees F ±3 degrees F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73 degrees F ±3 degrees F. Measurement to determine expansion expressed as a percentage of original length shall be made at age 7 days. This length at age 7 days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73 degrees F ±3 degrees F and 50 percent ±4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as specified in Part 2, herein.

K. Construction Tolerances: The CONTRACTOR shall set and maintain concrete forms and perform finishing operations so as to ensure that the completed work is within the tolerances specified in Section [03100] “Concrete Formwork”. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances.

L. For each class of fly ash, all testing and sampling procedures shall conform with these Specifications and ASTM C 311, including the restriction that one sample weighing 4 pounds shall be taken from at least each 200 tons of fly ash supplied.

M. Separate storage facilities shall be provided for fly ash and other supplementary cementitious materials (SCM). All SCM shall be stored in such a manner as to permit ready access for the purpose of inspection and sampling and suitably protected against contamination or moisture. Should any SCM show evidence of contamination or moisture or be otherwise unsuitable, the INSPECTOR may reject it and require that it be removed from the site. Each SCM used in concrete for this project shall be from the same source.

PART 2 -- PRODUCTS

2.1 CONCRETE MATERIALS

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

B. All materials furnished for the work shall comply with the requirements of ACI 301, as applicable. For bridge structures, materials for concrete shall conform to Section 90-2 to 90-4 of CSS.

C. Storage of materials shall conform to the requirements of ACI 301.

D. Materials for concrete shall conform to the Standard Specifications and the following requirements.

1. Concurrent with strength design criteria, concrete shall also be proportioned to provide the requisite durability to satisfy the exposure conditions imposed by either environment and/or service. Durability, in this context, refers to the ability of the concrete to resist deterioration from the environment or service in which it is placed. Concrete proportioned in accordance with ACI 318, or ACI 350 for sanitary structures, chapter 4, Durability Requirements, will meet this criteria.

2. Cementitious Materials:

    a. Portland Cement shall conform to ASTM C 150, Type [II] [I/II] [III] [V].
    b. Supplementary Cementitious Materials:
        i. Fly ash shall conform to ASTM C 618, Class F or C.
        ii. Slag cement shall conform to ASTM C 989, Grade 100 or 120.
        iii. Silica fume shall conform to ASTM C 1240, and shall be BASF Corporation's MasterLife SF100, GCP Applied Technologies (formerly W. R. Grace) F10KD, or approved equal.
        iv. Metakaolin shall conform to ASTM C 618, Class N, and shall be BASF Kaolin's (part of BASF Corporation) MetaMax, GCP Applied Technologies (formerly W. R. Grace) HRMK 100, or approved equal.

3. Aggregates shall be obtained from pits acceptable to the INSPECTOR, shall be non-reactive, and shall conform to ASTM C 33. Lightweight sand for fine aggregate will not be permitted.

    a. When tested in accordance with ASTM C 289, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.

    b. When tested in accordance with ASTM C 40, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

    c. When tested in accordance with ASTM C 131, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.

    d. When tested in accordance with ASTM C 88, the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.

    e. When tested in accordance with ASTM C 117, materials finer than No. 200 sieve shall not exceed 1% for gravel, and 1.5% for crushed aggregate.

    f. When tested in accordance with ASTM D 2419, the California sand equivalent values operating range shall not be below 71%.

4. Ready-mixed concrete shall conform to the requirements of ASTM C 94.

    a. Water for mixing shall conform to ASTM C 1602 and be clean and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities. The use of qualifying recycled water is encouraged**.** Mixing water that contains non-potable water should comply with ASTM C1602 Section 4 and Section 5 including Table 1 and Table 2

5. Water for mixing shall conform to the SSPWC, Section 201-1.2.3, "Water". The use of qualifying recycled water is encouraged.

6. Admixtures: The ENGINEER may require the use of admixtures or the CONTRACTOR may propose to use admixtures to control the set, effect water reduction, increase workability or enhance durability. In either case, the addition of an admixture shall be at the CONTRACTOR's expense. The use and continued use of an admixture shall be approved by the ENGINEER. Admixtures specified herein, other than calcium chloride, shall conform

to the requirements of ASTM C 494 or other standards specified in this Section. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used. Admixtures shall contain no free chloride ions, be non-toxic after 30 days, and shall be compatible with and made by the same manufacturer as the air entraining admixture.

These admixtures shall not be used in greater doses than those recommended by the manufacturer or permitted by the ENGINEER. The permitted dosage of the admixture shall not exceed that which will result in an increase in the drying shrinkage of the concrete in excess of 20 percent when used in precast or prestressed concrete, or 10 percent when used in any other structural concrete. The strength of concrete containing the admixture in the amount proposed shall, at the age of 48 hours and longer be not less than that of similar concrete without the admixture. The admixture shall not adversely affect the specified air content, unless permitted by the ENGINEER.

a. Set controlling admixture shall be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture conforming to ASTM C 494, Type B or D, such as Sika Corporation's Plastiment, BASF Corporation's MasterSet R Series or MasterSet DELVO Series**,** GCP applied Technologies (formerly W. R. Grace), Recover or Daratard 17 or an approved equal shall be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a set accelerating admixture conforming to ASTM C 494 Type C or E, such as Sika Corporation's Plastocrete 161FL, BASF Corporation's MasterSet AC 534 or MasterSet FP 20, GCP applied Technologies (formerly W. R. Grace), Daraset 400 or Polarset or an approved equal shall be used.

b. Normal and mid-range water reducing admixtures shall conform to ASTM C 494, Type A, and shall be BASF Corporation's MasterPozzolith Series, MasterPolyheed series, GCP applied Technologies (formerly W. R. Grace), ADVA series, Zyla series, WRDA series or approved equal. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations.

c. High range water reducer shall conform to ASTM C 494, Type F or G.

   If the high range water reducing admixture is added to the concrete at the batch plant, it shall be, ADVA series ADVA 190, ADVA 198, ADVA 140M as manufactured by GCP Applied Technologies (formerly W. R. Grace) MasterRheobuild 1000, MasterGlenium Series, or PS 1466 as manufactured by BASF Corporation; or an approved equal**.** High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified.

   If the high range water reducer is added to the concrete at the job site, it shall be used in conjunction with a normal water reducer and shall be MasterPozzolith 700 or MasterPozzolith 322 and MasterGlenium 7500 or MasterGlenium 3030, as manufactured by BASF Corporation; ADVA series ADVA 190, ADVA 198, ADVA 140M and Zyla Series, Zyla 625 or WRDA series, WRDA 64 as manufactured by GCP Applied technologies (formerly W. R. Grace); or an approved equal. Concrete shall have a slump of 3-inches ± 1/2-inch prior to adding the high range water reducing admixture at the job site. Slump shall not exceed 9 inches for concrete after addition of high-range water-reducing admixture. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

   Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

d. Concrete Waterproofing Admixture: Xypex Concentrate Admix C-1000 (standard set time) or C-2000 (extended set time), or BASF Corporation's MasterLife 300D, or Penetron Corp. Penetron SB, or approved equal that shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. Use of waterproofing admixture shall be at locations specified per the contract drawings and shall follow all manufacturer recommendations for quantity and preparation.

e. Air-entraining admixture meeting the requirements of ASTM C 260, such as MASTER BUILDERS SOLUTIONS Corporation's MasterAir Series or, GCP Applied Technologies (formerly W. R. Grace Daravair or Darex series, approved equal, shall be used. Sufficient air-entraining agent shall be used to provide a total air content of 3 to 4 percent; provided that, when the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the total air content provided shall be 5 to 6 percent. The CITY reserves the right, at any time, to sample and test the air-entraining agent received on the job by the CONTRACTOR. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

f. Workability-retaining admixture shall conform to ASTM C 494, Type S, shall retain concrete workability without affecting time of setting or early age strength development, and shall be BASF Corporation's MasterSure Z60, GCP Applied Technologies (formerly W. R. Grace) ADVA XT2, or approved equal.

g. Corrosion-inhibiting admixture shall be a nominal 30 percent solution of calcium nitrite or an amine/ester-based organic corrosion-inhibiting admixture, and shall be BASF Corporation's MasterLife CI 30, MasterLife CI 222, GCP Applied Technologies (formerly W. R. Grace) DCI series**,** or approved equal.

h. Shrinkage-reducing admixture shall conform to ASTM C 494, Type S, and shall be BASF Corporation's MasterLife SRA 20, MasterLife CRA 007, GCP Applied Technologies (formerly W. R. Grace) Eclipse series, or approved equal.

i. Alkali-silica reaction inhibiting admixture shall conform to ASTM C 494, Type S, shall contain a nominal lithium nitrate content of 30 percent, and shall be BASF Corporation's MasterLife ASR 30, GCP Applied Technologies (formerly W. R. Grace) RASIR, or approved equal.

j. Calcium Chloride: Except as otherwise provided herein, calcium chloride will not be permitted to be used in concrete.

7. Fibers:

a. Microsynthetic fibers shall conform to ASTM C 1116, Type III and shall provide a minimum crack reduction ratio (CRR) of [40] [__| percent when tested in accordance with ASTM C 1579, and shall be MASTER BUILDERS SOLUTIONS Corporation's MasterFiber F Series, MasterFiber M Series, GCP Applied Technologies (formerly W. R. Grace) Grace Fibers, Grace Microfibers, or approved equal.

b. Macrosynthetic fibers shall conform to ASTM C 1116, shall have an equivalent flexural strength ratio ($R_{e,3}$) of [__] percent when tested in accordance with ASTM C 1609, [shall have a toughness of [__] Joules when tested in accordance with ASTM C 1550], and shall be MASTER BUILDERS SOLUTIONS Corporation's MasterFiber MAC Series, GCP Applied Technologies (formerly W. R. Grace) STRUX series or approved equal

2.2 CURING MATERIALS

A. Materials for curing concrete shall conform to Section 03370 “Curing Concrete”, Part 2.

2.3 NON-WATERSTOP JOINT MATERIALS

A. Materials for non-waterstop joints in concrete shall conform to Section 03290 “Joints In Concrete”, Part 2.

2.4 MISCELLANEOUS MATERIALS

A. Floor sealer/hardener shall be a colorless, aqueous solution of zinc and/or magnesium fluorosilicate or of sodium silicate, and shall be as manufactured by BASF Corporation, W.R. Grace Co., or an approved equal. The solution shall be delivered ready for use in the manufacturer's original sealed containers. Each gallon of the fluorosilicate solution shall contain not less than 2 pounds of crystals.

B. Dampproofing agent shall be an asphalt emulsion, such as MasterSeal 610, MasterSeal 614 or MasterSeal 615 (formerly Hydrocide 600, Hydrocide 700 & Hydrocide 700B) by BASF Corporation, GCP Applied Technologies (formerly W. R. Grace) Darapel, Flintkote C-13-E Foundation Coating, or an approved equal.

C. Epoxy adhesives shall be per the following products for the applications specified:

2c For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur Hi-Mod Epoxy Adhesive, as manufactured by Sika Corporation; MasterEmaco ADH 326 (formerly Concresive Liquid LPL) as manufactured by BASF Corporation**;** or an approved equal.

3c For bonding hardened concrete or masonry to steel, MasterEmaco ADH 327RS (formerly Concresive Paste SPL), Colma-Dur Gel, Sikadur Hi-Mod Gel, or an approved equal.

D. Drypack: Field mixture of 1 part Portland cement to 2 parts fine aggregate mixed to a damp consistency such that a ball molded in the hands will stick together and hold its shape. At CONTRACTOR's option, the specified admixture may be added for increased workability at lower water/cement ratio. In lieu of field mixing, CONTRACTOR may use factory mixed drypack material, such as BASF Corporation “MasterFlow 100” or Euclid "Euco Dry Pack Grout", or an approved equal.

E. Expansion Joint Filler: Asphalt impregnated fiber or non-extruding foam type, conforming to ASTM D994 and D1751, or D1752.

F. Construction Joint Materials: “Key-Kold”, “Kwik-Joint” of profiles indicated, or an approved equal.

G. Bonding Agent: “Weld-Crete”, manufactured by Larsen Products Co. or ”MasterEmaco ADH” Series (formerly Concresive Series), as manufactured by BASF Corporation, or an approved equal.

H. Integral Color Concrete: As specified in Section 03331

I. For bridge structures, prestressing concrete materials shall comply with CSS Section 50.

J. For bridge structures, epoxy adhesives shall comply with CSS Section 95-2.

2.5 CONCRETE DESIGN REQUIREMENTS

A. General: Concrete shall be composed of cement, SCM, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to

be used for different parts of the work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. Mix designs with more than 41 percent of sand of the total weight of fine and coarse aggregate shall not be used. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the CITY. All changes shall be subject to review by the ENGINEER.

B. W/cm and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

Type of Work	Min. 28-Day Compressive Strength (psi)	Aggregate Gradation	Cement per cu yd (sacks)	Max w/cm (by weight)
Structural Concrete *				
a. Sanitary Structures:	4,000	C	7.0	0.45
b. Other Structures **:	3,250	C	6.0	0.54 **
Sitework concrete:	2,500	C	5.5	0.50
Lean concrete:	2,000	C	4.8	0.71

Note: One sack of cement equals 94 lb.
* Use “B” Aggregate gradation when placing conditions permit.
** For Slabs on grade, maximum w/cm shall be 0.45.

C Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the CONTRACTOR shall be entitled to no additional compensation because of such changes.

D. Fly ash/pozzolan may be used per requirements of the Standard Specifications, when approved by the ENGINEER as a partial cement replacement in concrete as follows:

4c Fly ash shall replace not more than 20 percent by weight of the Portland cement in the design mix. The design mix shall contain a minimum of 7 sacks of cement per cubic yard before the replacement is made.

5c Fly ash for hydraulic/liquid containing structures shall be Class F fly ash only. Fly ash for all other structures shall be Class C or F fly ash.

2.6 CONSISTENCY

The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein specified to give the desired density, impermeability and smoothness of surface. Subject to the w/c ratio requirements of section 2.5, the quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:

Part of Work	Slump (in)
With high range water reducer added	9-inches max

Other work	per Standard Specifications

2.7 TRIAL BATCH AND LABORATORY TESTS

A. Before placing any concrete, a Department of Building and Safety certified testing laboratory approved by the ENGINEER shall prepare, within 30 calendar days after the date of the Notice to Proceed, a trial batch of each concrete mix, based on the preliminary concrete mixes submitted by the CONTRACTOR. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the CONTRACTOR. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the CONTRACTOR's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage, and 10 compression test specimens from each batch. The cost of not more than 3 laboratory trial batch tests for each specified concrete strength shall be borne by the CONTRACTOR. Any additional trial batch testing required shall be performed at the expense of the CONTRACTOR.

The trial batch procedure may be waived when test data of prior performance of the proposed mix design, performed by a Department of Building and Safety certified testing laboratory, is presented by the CONTRACTOR and approved by the ENGINEER.

The requirements of this section may be waived for concrete mixes specified by the Class per the Standard Specifications.

B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C 192 and ASTM C 39. Five compression test cylinders shall be tested at 7 days and 5 at 28 days. The average compressive strength for the 5 cylinders tested at 28 days for any given trial batch shall not be less than the appropriate sections of ACI 318 of the specified compressive strength.

C. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136. Values shall be given for percent passing each sieve.

2.8 SHRINKAGE LIMITATION

A. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.036 percent or 0.042 percent, respectively. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Testing for shrinkage but be performed as one of the first items of work.

B. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent. The CONTRACTOR may conduct additional C157 testing of the mix design identified in 2.8.A using field prepared samples, following the instructions of ASTM C172 and establish a shrinkage correlation between field and laboratory casted samples. However, such testing must be performed soon after a mix design has been accepted by the ENGINEER. Number of samples, preparation, storage, and testing to be approved by the ENGINEER.

C. If the required shrinkage limitation is not met during construction, the CONTRACTOR shall take any or all of the following actions, at no additional cost to the CITY, for securing the specified shrinkage requirements. These actions may include changing the source or aggregates, cement and/or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the

number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or the effects of shrinkage.

2.9 MEASUREMENT OF CEMENT AND AGGREGATE

The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the ENGINEER; provided that, where batches are so proportioned as to contain an integral number of conventional sacks of cement, and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 pounds.

2.10 MEASUREMENT OF WATER

The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the ENGINEER and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any specified amount of water to each batch of concrete, and the meter shall include a set-back register with a readily visible vertical face and double hands indicating in cubic feet and decimals thereof. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism must be such that leakage will not occur when the valves are closed

2.11 READY-MIXED CONCRETE

A. At the CONTRACTOR's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the following supplementary requirements.

B. Ready-mixed concrete shall be delivered to the site of the work, and discharge shall be completed within 90 minutes after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In hot weather, or under conditions contributing to quick stiffening of the concrete, the ready-mixed concrete shall be discharged before the temperature of the concrete exceeds 90 degrees F.

C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be of the re-settable, recording type, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than 2-inches when the specified slump is more than 3-inches, the mixer shall not be used on the work unless the causing condition is corrected and satisfactory performance is verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

F. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a certified weighmaster delivery ticket furnished to the INSPECTOR in accordance with the Paragraph in Part 1 entitled "Certified Delivery Tickets".

G. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the INSPECTOR.

H Mixing and Transporting of concrete for bridge structures shall comply with Section 90-6 of CSS.

2.12 PRESTRESSING CONCRETE

Prestressing of concrete for bridge structures shall comply with Section 50 of CSS.

2.13 CONCRETE BARRIER

Concrete barrier materials shall comply with Section 83-2.02 of CSS.

PART 3 -- EXECUTION

3.1 PROPORTIONING AND MIXING

A. Proportioning: Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301; provided that the maximum slump for any concrete shall not exceed 4-inches except when the use of high range water reducer is permitted which increases the maximum slump to 8-inches. Proportioning for bridge structures shall comply with Section 90-5 of the CSS.

B. Mixing: Mixing of concrete shall conform to the requirements of Chapter 7 of said ACI 301 Specifications and SSPWC. Whichever is most stringent shall apply.

C. Slump: Maximum slumps shall be as specified herein in Section 2.6.

D. Retempering: Retempering of concrete or mortar which has partially hardened will not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. General: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce adsorption and to help maintain concrete workability. Earth surfaces shall be thoroughly wetted by sprinkling, 24 hours prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Vapor Barrier: Install under interior floor slabs on grade. Lap joints 6" in the direction of concrete spreading and tape seal. Seal the joints at walls and around penetrations with tape. Cover barrier with 2" layer of clean damp sand.

C. Screeds: Set screeds at walls and maximum 8’ centers between. Set to provide level floor. Check with an instrument level, transit, or laser during placing operation to maintain level floor.

D. Screeds Over Vapor Barrier: Use weighted pad or cradle type screeds and do not drive stakes through the vapor barrier. Check with an instrument level, transit, or laser.

E. Metal Floor Decking: Verify that decking joints are sealed and there are no openings or voids that will permit concrete leakage.

F. Expansion Joint Filler: Install where slabs abut buildings and elsewhere as indicated. Install full depth of concrete with top level with finished surface of concrete.

G. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the old concrete has been stopped or interrupted so that, as determined by the ENGINEER, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, and foreign material. Such cleaning shall be accomplished by sandblasting followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

H. After the surfaces have been prepared all approximately horizontal construction joints shall be covered with a layer of mortar approximately two-inch thick, or as shown on the plans. The mortar shall have the same proportions of cement and sand as the regular concrete mixture. The water-cement ratio of the mortar in place shall not exceed that of the concrete to be placed upon it, and the consistency of the mortar shall be suitable for placing and working in the manner hereinafter specified. The mortar shall be spread uniformly and shall be worked thoroughly into all irregularities of the surface. Wire brooms shall be used where possible to scrub the mortar into the surface. Concrete shall be placed immediately upon the fresh mortar. When casting deep walls (more than 6 feet high) over slabs or footings, in lieu of the two-inch thick mortar, a 6-inch lift of a rich pea gravel mix with the same water-cement ratio as the wall concrete shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.

I. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and ACCEPTED by the INSPECTOR at least 24 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.

J. Conduits and Sleeves:

1. Locate so as not to reduce the strength of construction. Do not place pipes, except conduits in a slab of less than 3-1/2" thickness.

2. In supported concrete slabs, do not bury conduit having any outside diameter greater than 33% of the thickness of the slab. Increase slab thickness locally to meet this requirement.

3. Do not place conduit between the bottom of reinforcing steel and the bottom of supported slab.

4. In placing conduits at slabs on earth, place below the reinforcement, and encase in concrete by increasing thickness of the slab locally to at least 3" of concrete around the conduit on all sides.

K. All inserts or other embedded items shall conform to the requirements herein.

L. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the INSPECTOR before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.

M. Where concrete is to be cast against old concrete, (greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by sand-blasting, exposing the aggregate. In concrete shear-walls, suspended slabs and roof slabs, the interface surface at construction joints shall be roughened to a full amplitude of one quarter inch. The hardened surface shall be cleaned of all latent foreign material and washed clean, prior to the application of an epoxy bonding agent.

N. Concrete shall not be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. Concrete shall not be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the ENGINEER.

O. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

P. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.

Q. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.

R. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

3.3 HANDLING, TRANSPORTING, AND PLACING

A. General: Do not place concrete during rain or adverse weather conditions without means to prevent all damage. Conform to requirements specified hereinafter whenever concrete placement is required during cold or hot weather. Placing of concrete shall conform to the applicable requirements of ACI 301 and the requirements of this Section.

B. Non-Conforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced by and at the expense of the CONTRACTOR.

C. Concrete shall not be placed except in the presence of duly authorized representative of the INSPECTOR. The CONTRACTOR shall notify the INSPECTOR in writing at least 48 hours in advance of placement of any concrete.

D. Placement in Wall Forms: Concrete shall not be dropped through reinforcement steel or into any deep form, whether reinforcement is present or not, causing separation of the coarse aggregate from the mortar on account of repeatedly hitting rods or the sides of the form as it falls, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid

inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour.

E. Casting New Concrete Against Old: An approved epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is installed, see Section [03290], "Joints in Concrete".

F. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the CONTRACTOR'S conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the ENGINEER. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

G. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the pour. As the work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

H. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 40 degrees F in moderate weather, and not less than 50 degrees F in weather during which the mean daily temperature drops below 40 degrees F. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

I. Cold Weather Placement:

1. Earth foundations shall be free from frost or ice when concrete is placed upon or against them. Fly ash concrete shall not be placed when the air temperature falls below 50 degrees F.

2. Normal Concrete: When the temperature is below 40 degrees F, the temperature of the concrete placed in the forms shall be at least 60 degrees F. When the temperature is below 30 degrees F, the temperature of the concrete as mixed shall be 65°F. In all cases, when the daily average temperature is below 40 degrees F, the concrete shall be kept at 55 degrees F for the 72 hours, and then allowed to drop uniformly to the air temperature over the next 24 hours. Concrete temperature shall be measured by placing a thermometer 2" below the top of the concrete being placed.

3. Air-entrained concrete shall be kept at the above temperature for 27 hours and above freezing for an additional 72 hours.

4. No calcium chloride shall be used to accelerate hardening of concrete. CONTRACTOR to certify that any additive used does not contain calcium chloride.

5. If low temperature accelerating admixture is proposed, adjust concrete mix as required and obtain approval of the ENGINEER.

6. All concrete materials, reinforcement, forming materials and ground with which concrete is to come in contact shall be free of frost.

7. The covering or other protection used in connection with the curing shall remain in place and intact for at least 24 hours.

8. The work shall be protected from the elements, flowing water, and defacements of any nature during the construction operations.

9. Conform to the provisions of ACI 306.1, except as modified herein.

J. Hot Weather Placement:

Conform to ACI 305.1 and the following requirements:

1. Take extra care to reduce the temperature of the concrete being placed, and to prevent rapid drying of newly placed concrete. When the outdoor ambient temperature is more than 90 degrees F, shade the fresh concrete as soon as possible after placing, use an evaporation reducer or fogging to minimize rapid drying. and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit it without damage.

2. Concrete placement temperatures shall be controlled by the CONTRACTOR and shall not be limited to:

   a. Shading and cooling the aggregate;

   b. Avoiding use of hot cement;

   c. Cooling mixing water by additions of ice;

   d. Insulating water supply lines and tanks; and

   e. Insulating mixer drums or cooling them with sprays or wet burlap.

K. Cast-in-place concrete shall be homogeneous throughout the structural element. The methods used to place shall prevent segregation. Placement of concrete for bridge structures shall conform to Section 51-1 of the CSS.

3.4 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: The pumping equipment must have 2 cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the site during pumping.

C. The minimum diameter of the hose (conduits) shall be 4-inches.

D. Pumping equipment and hoses (conduits) that are not functioning properly, shall be replaced.
E. Aluminum conduits for conveying the concrete will not be permitted.

F. Gradation of coarse aggregates shall conform to ASTM C 33 and shall be as close to the middle range as possible.

G. Gradation of fine aggregate shall conform to ASTM C 33, with 15 to 30 percent passing the number 50 screen and 5 to 10 percent passing the number 100 screen. The fineness modulus of sand used shall not be over 3.00.

H. Field Control: Concrete samples for slump per ASTM C 143 and test cylinders per ASTM C 31 and C 39.

3.5 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the work shall be acceptable to the ENGINEER. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 14 days.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.6 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be high speed power vibrators (8,000 to 10,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required.

B. Operation of Vibrators: Do not horizontally transport concrete in forms with vibrators nor allow vibrators to contact forms or reinforcing. Push vibrators vertically into the preceding layers that are still plastic and slowly withdraw, producing maximum obtainable density in concrete without creating voids or segregation. In no case disturb concrete that has partially set. Vibrate at intervals not exceeding two-thirds the effective visible vibration diameter of the submerged vibrator. Avoid excessive vibration that causes segregation. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete".

C. Correction of Segregation: Before placing next layer of concrete, and at the top of last placement for vertical elements, remove concrete containing excess water or fine aggregate or showing deficiency of coarse aggregate and fill the space with compacted concrete of correct proportions.

D. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

E. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein

specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall be kept from contact with the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 FINISHING CONCRETE SURFACES

A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified in Part 1, herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.

B. Formed Surfaces: Formed surfaces for all structures other than building structures and bridge decks, shall be finished per Section 303-1.9 of Standard Specifications. Concrete for bridge decks shall be finished per CSS Section 51-1.17. Concrete for building and retaining wall structures shall be finished per architectural finish as specified hereon, or as shown on Drawings.

3.8 CURING AND DAMPPROOFING

Curing and Dampproofing shall conform to Section [03370] “Curing Concrete”, Part 3.

3.9 PROTECTION

The CONTRACTOR shall protect all concrete against injury until final acceptance by the CITY. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring. Immediately following the first frost in the fall, the CONTRACTOR shall be prepared to protect all concrete against freezing. After the first frost, and until the mean daily temperature in the vicinity of the worksite falls below 40 degrees F for more than one day, the concrete shall be maintained at a temperature not lower than 50 degrees F for at least 72 hours after it is placed.

The CONTRACTOR shall protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the CITY. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the CONTRACTOR'S expense.

3.10 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the CONTRACTOR at its own expense.

B. Defective surfaces to be repaired shall be cut back from true line a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not

required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair purposes shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of Atlas white Portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with non-shrink grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with non-shrink grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

E. Prior to filling any structure with water, all cracks that may have developed shall be repaired to the satisfaction of the ENGINEER. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

3.11 PRESTRESSING CONCRETE

Prestressing concrete for bridge structures shall comply with CSS Section 50.

3.12 CONCRETE BARRIER

Concrete barrier construction shall comply with Section 83-2.02 of CSS.

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SECTION 03315
GROUT

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish all materials for grout in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. All grouts shall be City of Los Angeles approved product. The CONTRACTOR shall submit a copy of the Los Angeles Research Report with submittals.

C. The following types of grout shall be covered in this Section:

1. Non-Shrink Grout: This type of grout is to be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced.

2. Cement Grout

3. Epoxy Grout

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03300 Cast-in-Place Concrete.

B. Section 03400 Precast Concrete.

C. Section 03740 Concrete Repair.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

C. Comply with the reference standards of the GENERAL REQUIREMENTS.

D. Comply with the current provisions of the following Codes and Standards, as applicable.

1. Commercial Standards:

CRD-C 621	Corps of Engineers Specification for Non-shrink Grout
ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
ASTM C 531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical- Resistant Mortars, Grouts, and Monolithic Surfacings
ASTM C 579	Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings
ASTM C 827	Test Method for Early Volume Change of Cementitious Mixtures
ASTM C 1107	Standard Specification for Packaged dry hydraulic cement grout (non-shrink)

ASTM D 696	Test Method for Coefficient of Linear Thermal Expansion of Plastics

2. Other Government Standards:

CSS	Caltrans Standard Specifications.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. The CONTRACTOR shall submit certified test results verifying the compressive strength, shrinkage, and expansion requirements specified herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.5 QUALITY ASSURANCE

A. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the ENGINEER to insure continued compliance with these specifications. The specimens will be made by the INSPECTOR

2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.

3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.

4. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the CONTRACTOR.

5. The cost of all laboratory tests on grout will be borne by the CITY, but the CONTRACTOR shall assist the INSPECTOR in obtaining specimens for testing. However, the CONTRACTOR shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The CONTRACTOR shall supply all materials necessary for fabricating and containing the test specimens.

B. Construction Tolerances: Construction tolerances shall be as specified in the Section 03310, "Cast-in-Place Concrete," except as modified herein and elsewhere in the Contract Documents.

C. The grout used in post-tensioned prestressing systems of bridge structures, shall comply with CSS Section 50-1.09.

PART 2 -- PRODUCTS

2.1 CEMENT GROUT

A. Cement Grout: Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary for the mixture to flow under its own weight. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. In addition, where needed, an approved admixture may be added to increase workability at a low water/cement ratio. The minimum compressive strength at 28 days shall be 4000 psi.

B. Cement grout materials shall be as specified in Section 03300, "Cast-in-Place Concrete".

2.2 PREPACKAGED GROUTS

A. Non-Shrink Grout:

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating when tested in accordance with C1107, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

2. Class A non-shrink grouts shall have a minimum 28 day compressive strength of 5,000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C 827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C 621.

3. Class B non-shrink grouts shall have a minimum 28 day compressive strength of 5,000 psi and shall meet the requirements of CRD C 621.

4. Application:

a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout and epoxy grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

B. Epoxy Grout:

1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.

4. The epoxy grout shall develop a compressive strength of 5,000 psi in 24 hours and 10,000 psi in seven days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2-inch diameter by 4-inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.

6. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30 x 10^{-6} inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.

7. The CONTRACTOR shall demonstrate the ability of the epoxy grout system to completely fill the size and depth of the intended hole, blockout, or area before the system is submitted for consideration by the ENGINEER.

8. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications required in the Contract Documents.

2.3 CURING MATERIALS

Curing materials shall be as specified in Section 03300, "Cast-in-Place Concrete" for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.4 CONSISTENCY

The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

2.5 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

C. Measurement of ingredients for grout used in prestressing systems of bridge structures shall conform to Section 50-1.09 of the CSS.

PART 3 -- EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03300, "Cast-in-Place Concrete". The finish of the grout surface shall match that of the adjacent concrete.

B. The manufacturer of Class A non-shrink grout and epoxy grout shall provide on-site technical assistance upon request. All costs related to this requirement shall be borne by the CONTRACTOR.

C. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

D. Application of grout used in prestressing systems of bridge structures shall conform to Section 50-1.09 of the CSS.

3.2 CONSOLIDATION

Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

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SECTION 03360
PNEUMATICALLY-PLACED CONCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish, place, finish, cure, and protect all pneumatically-placed concrete, and shall furnish and install all appurtenant work, in accordance with the requirements of the Contract Documents.

B. Pneumatically-placed concrete shall be applied by the dry-mix process (Gunite) or the wet-mix process (Shotcrete) as specified on the project plans, and as defined by Section 303-2 of the Standard Specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03200 Reinforcement Steel.

B. Section 03300 Cast-in-Place Concrete.

C. Section 03370 Concrete Curing.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference standards and Standard Specifications of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards, as applicable.

1. Commercial Standards:

SSPC – SP6	Steel Structures Painting Council Report
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	Specifications for Structural Concrete for Buildings
ACI 305R	Standard Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 506	Recommended Practice for Shotcreting
ACI 506.2	Specifications for Materials, Proportioning and Application of Shotcrete
ASTM C 33	Specifications for Concrete Aggregates
ASTM C 42	Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 87	Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar

ASTM C 94	Specifications for Ready-Mixed Concrete
ASTM C 173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 183	Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 685	Specifications for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 979	Specifications for for Pigments for Integrally Colored Concrete
ASTM C 1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C 1140	Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels

2. City Standards:

P/BC 2002-051	City of Los Angeles Department of Building and Safety Information Bulletin / Public – Building Code Document regarding wet mix concrete. Applicable when project falls under dual jurisdiction of the Department of Public Works and Department of Building and Safety.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided.

1. Shop Drawings: The CONTRACTOR shall provide shop drawings of all steel reinforcing.

2. Certificates: The CONTRACTOR shall provide certificates from manufacturers or suppliers certifying that the materials supplied conform to the requirements of the Contract Documents.

3. The CONTRACTOR shall also submit:

a. Information concerning the source and quality of materials.

b. Representative samples of materials for materials testing, and preparation of test panels.

c. Recommended mix proportions and test results for acceptance.

d. Resumes of all Sub-Contractors and nozzlepersons who will perform the work under this section, per Section 1.5 hereon.

1.5 QUALITY ASSURANCE

A. CONTRACTOR's Qualifications: The CONTRACTOR shall use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Pneumatic Concrete Contractor Qualifications: The Contractor shall have a minimum of 5 years experience in similar work, in scope and size. The CONTRACTOR shall provide the ENGINEER with a written resume of experience in similar work, other than swimming pools, including location and sizes of previous jobs.

C. Special Inspection: It is required that all pneumatically-placed concrete work specified herein shall be subject to continuous inspection at the job site by a special inspector certified by the Los Angeles Department of Building and Safety, and no such work shall be scheduled or performed without making prior arrangements to have said special inspector present during all such construction operations hereunder. The CITY will provide a Registered Deputy Building Inspector at no cost to the CONTRACTOR. A minimum of 48 hours advance notice is required for all required inspections under this section.

D. At least 10 working days prior to constructing any test panels, the CONTRACTOR shall submit to the ENGINEER for approval, a Quality Control Plan (QCP) for the proposed method of gunite or shotcrete placement. The plan shall include the following:

1. The number and qualifications of nozzlepersons available to place pneumatically-placed concrete, the number of nozzlepersons on-site at any time during the placement, description of their work schedule, and the procedures for avoiding fatigue of any nozzleperson. The nozzleperson shall have a minimum of 3,000 hours experience as a nozzleperson on projects with a similar application.

2. The proposed method of placement, including, but not limited to, application rates, details of any proposed construction joints and their locations, and methods for achieving the required thickness and surface finish.

3. The procedure for curing surfaces.

4. The description of a debris containment system, to be used during the cleaning of bar reinforcing steel and concrete and construction of the pneumatically-placed concrete, as required to provide for public safety.

The ENGINEER shall have 10 working days to review and approve the QCP submittal after a complete plan has been received. No construction of pneumatically-placed concrete test panels shall be performed until the QCP is approved by the ENGINEER.

E. Prior to performing work, the CONTRACTOR shall construct test panels as specified below and as required by the City of Los Angeles Building Code, unless otherwise specified. Test panels shall be constructed by the nozzlepersons and application crew scheduled to do the work, using equipment, materials, mixing proportions, ambient temperatures and procedures proposed for the work. The test panels shall conform to the following:

1. Preparation, securing, and testing of panel molds and specimens shall be performed by a City of Los Angeles approved laboratory and as acceptable by the Engineer and Inspector. Submit a minimum of two (2) laboratories for selection.

2. Two (2) Test panel(s) shall be 4' x 4' of the thickness, and with typical reinforcement to be expected in the work. Prepare a set of test panels for each proposed mix proportion, each anticipated shooting orientation, and each proposed nozzleman. One of each set of panels shall only be reinforced on half of the panel area – the other half shall left unreinforced.

Clearly mark this latter panel. Prepare and test panels in accordance with ASTM C 1140, unless noted otherwise herein.

3. After shooting, but before the concrete has fully set, the CONTRACTOR shall disassemble the fully reinforced panels(s) of each set, in the presence of the ENGINEER and the Deputy INSPECTOR, to assure that the team and equipment to be used is capable of providing sound pneumatically-placed concrete, free of voids, sags, segregation, honeycombing, lamination, dry patches, slugs and similar defects.

4. After a minimum of seven (7) days, obtain six (6) test specimens from the half-reinforced panel with three being non-reinforced specimens and three with reinforcing steel. Test the non-reinforced specimens for compliance with the specified physical property in accordance with ASTM C 42. Visually grade the reinforced specimens. Only nozzlemen with a test panel mean core grade less than or equal to 2.0 shall be allowed to place pneumatically-placed concrete.

5. Repeat panels' qualification and corresponding specimen testing when first sets prove unsatisfactory, until the ENGINEER's and Deputy INSPECTOR's acceptance are obtained. However, when a nozzleman's second mean core grade is greater than 2.0, that nozzleman shall not be permitted to shoot on the project.

6. Application of pneumatically-placed concrete in the work shall not proceed until the test panels have been disassembled, inspected and results of specimens accepted.

F. All pneumatically-placed concrete which does not comply with this Section, lacks uniformity, exhibits segregation, honeycombing, rebound, sagging, sloughing, and lamination, or which contains dry patches, slugs, voids, or sand pockets, shall be removed and replaced at the CONTRACTOR's expense. Replacements shall include all expenses of additional testing and inspections required as a result of such defective concrete.

G. The CONTRACTOR shall be responsible for obtaining and testing all required test cores. All coring and testing shall be at the CONTRACTOR's expense and performed in the presence of the ENGINEER, unless otherwise directed. The ENGINEER shall be notified a minimum of 48 hours prior to the CONTRACTOR performing any coring or testing operations. The testing shall be performed by an independent testing facility accepted by the ENGINEER and the INSPECTOR unless arrangements are made for the testing to be performed by the City's Testing Laboratory through a credit change order to the CITY. A copy of the test results shall be furnished to the ENGINEER within 5 days following completion of testing.

1.6 PROJECT CONDITIONS

A. Cold-Weather Shotcreting: Protect shotcrete work from physical damage or reduced strength caused by frost, freezing, or low temperatures according to ACI 306.1 and as follows:

1. Discontinue shotcreting when ambient temperature is 40 deg F and falling. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F and not more than 90 deg F.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.

4. Don not use calcium chloride, salt, and other materials containing antifreeze agents.

B. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:

1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below 100 deg F for dry mix or 90 deg F for wet mix.

2. Decrease temperature of reinforcing steel and receiving surfaces below 100 deg F before shotcreting.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Cement: Cement shall comply with the requirements of Section 03310, “Cast-In-Place Concrete”. Tensile strength of the cement, at 7 days, shall comply with ASTM C 183 requirements.

B. Aggregate: Aggregate shall conform to ACI 506.2, gradation No. 1 or No. 2, and it shall comply with requirements of ASTM C 33.

C. Water: Water for pneumatically-applied concrete shall be furnished by the CONTRACTOR. All water shall be clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities which might reduce the strength, durability, or other quality of the pneumatically-applied concrete.

D. Reinforcement: Steel reinforcement shall conform to the requirements of Section 03200, "Reinforcement Steel".

E. Admixtures: The use of Admixtures shall be limited to those specified in the approved mix design, in compliance with requirements of Section [03300], “Cast-In-Place Concrete”.

F. Ground Wire: High-strength steel wire, 0.8 to 1 mm in diameter.

G. Coloring Agent: ASTM C 979, natural or synthetic mineral-oxide pigments or colored, water-reducing admixtures, free of carbon black, color stable, nonfading, and resistant to lime and other alkalis.

1. Color: As selected by the ENGINEER from manufacturer’s full range

2.2 PROPORTIONING

A. Proportion dry mixes by field test data methods and wet mixes according to ACI 211.1 and ACI 301, using materials to be used on the project, to provide normal-weight pneumatic concrete with the properties listed below.

B. Compressive Strength: Unless otherwise specified, the minimum 28-day compressive strength of the pneumatically-placed concrete shall be 3,250 psi.

C. The minimum slump shall be 1.5" and the maximum slump shall be 2.5". Slump shall be measured at the point of discharge from the mixer, except the INSPECTOR may require slump tests at the discharge point where water may have been added.

PART 3 -- EXECUTION

3.1 GENERAL

A. Pneumatically-placed concrete shall be used on the work where shown; and, where not shown, may be used only with written approval of the ENGINEER.

3.2 RESTRICTIONS ON PLACING PNEUMATICALLY-PLACED CONCRETE

A. Wind: Pneumatically-placed concrete shall not be applied under strong wind conditions, as evidenced by the removal of a considerable amount of cement and moisture from the concrete spray; provided, that in areas where strong winds prevail and work must proceed, a richer mix than specified which is acceptable to the ENGINEER, shall be used. The nozzleperson shall work against the direction of the wind to avoid concrete being applied on rebound that has been carried with the wind. Shields shall be placed around the nozzleperson to prevent the loss of cement carried away by the wind.

B. Cold Weather: Pneumatically-placed concrete may be applied in cold weather; provided, that the surfaces are not frozen, the temperature during the day is expected to rise at least to 40 degrees F, and the night temperature of the first night after application is not predicted to drop below 27 degrees F; and provided further, that the CONTRACTOR shall apply concrete under these conditions solely at its own risk. In order to gain quicker setting-up times, Type III high-early-strength portland cement may be used.

C. Rain: Whenever rain has damaged newly-placed concrete, the ENGINEER may order such concrete to be removed when it has been determined that a significant amount of cement has been washed out. The CONTRACTOR prior to placing any new layers shall consult with the ENGINEER as to whether or not the concrete damaged by rain is acceptable to the ENGINEER or must be replaced.

D. Low Humidity: Under low humidity conditions (below 50 percent) in conjunction with wind, the CONTRACTOR shall immediately cease placing operations until there has been an improvement in the wind and humidity conditions as determined by the ENGINEER. Continuous water-curing shall be started as soon as the concrete has hardened sufficiently to prevent a washout of cement.

3.3 PROTECTION OF ADJACENT WORK

The CONTRACTOR shall take every possible precaution to protect adjacent work, concrete surfaces, vehicles, equipment, etc., from being damaged by overshooting concrete and by materials carried by the wind. Overshot concrete and rebound concrete shall be removed before it adheres.

3.4 BATCHING and MIXING

Mixing and placing of pneumatically-placed concrete shall conform to the requirements specified herein and to the applicable recommendations given in ACI 506, except the word “shall” shall be substituted whenever the word “should” is used.

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A. The CONTRACTOR shall control mix proportions by weight batching, or by volume batching in compliance with ASTM C 685, and the following:

1. If permitted, other volume batching procedures may be used, provided a minimum of one weight batching check is made every four hours for control purposes.

2. The CONTRACTOR shall assure that the specified mix design is achieved.

B. The CONTRACTOR shall use batching and mixing equipment capable of proportioning and mixing all ingredients (except water in the case of dry-mix equipment) at a rate that will provide adequate production, and with an accuracy that will assure uniformity of batches.

1. The weighing equipment used shall be capable of batching with the accuracy specified in ASTM C 94.

2. Volumetric equipment, if used, shall be capable of batching with the accuracy specified in ASTM C 685.

C. Ready-Mixed Concrete (if used):

1. Ready-Mixed Concrete shall comply with ASTM C 94; except the materials may be delivered to the equipment in the dry state if that equipment is capable of adding the water and mixing it satisfactorily with the dry ingredients; or

2. Ready-Mixed Concrete shall comply with ASTM C 685, in which case the ingredients shall be delivered dry, and proportioned and mixed at the job-site.

3.5 PREPARATION OF SURFACES

The existing surfaces to receive pneumatically-placed concrete shall be prepared in accordance to the Standard Specifications and the following requirements:

A. Existing Concrete or Masonry Surfaces:

1. Remove all existing unsound concrete material from substrate surfaces before applying pneumatically-placed concrete.

2. Chip or scarify areas to be repaired, and remove offsets which would cause an abrupt change in thickness without suitable reinforcement.

3. Taper the edges, and leave no square shoulders at the perimeter of the cavity.

4. Remove all loose material from areas receiving pneumatically-placed concrete.

5. Wet the surface until it is damp, but without visible free water.

B. Steel Surfaces:

1. Remove rust, oil, scale, and previously applied paint from surfaces receiving pneumatically-placed concrete.

2. Comply with Specification SSPC-SP6 of the Steel Structures Painting Council.

C. Forms:

1. Use form-coating material on removable forms to prevent absorption of moisture and to prevent bond with the pneumatically-placed concrete.

2. Use a non-stain material for surfaces exposed to view when construction is completed.

3. Do not use form-coating material that will interfere with subsequent bonding to the pneumatically-placed concrete, when such bonding is required.

3.6 JOINTS

Contraction control joints shall be provided in the locations shown; where not shown, such joints shall be provided at approximately 15 ft spacing each direction in the case of unreinforced pneumatically-placed concrete, and at approximately 30 ft spacing each direction in the case of

reinforced pneumatically-placed concrete. Construction joints shall be provided as shown, or if not shown, as placing stops at locations selected by the CONTRACTOR and acceptable to the ENGINEER. Joints shall be constructed per requirements of the Standard Specifications Section 303-2.

3.7 PLACEMENT

During placement operations, the CONTRACTOR shall control thickness, method of support, air pressure, and water content of pneumatically-placed concrete to preclude sagging or sloughing off.

1. The height of a layer shall be limited to 3 feet maximum and succeeding layers shall not be placed in less than 3 hours after lower section is in place.

2. Discontinue placement or provide suitable means to screen the nozzle stream if wind or air start to cause separation of the nozzle stream during placement.

3. Dampen absorptive substrates before placement to facilitate bond and to reduce the possibility of shrinkage cracking developing from premature loss of mixing water.

4. Broom or scarify the surface of freshly-placed pneumatically-placed concrete to which, after hardening, additional layers of pneumatically-placed concrete are to be bonded. Dampen surfaces just before application of succeeding layers.

5. Fill corners of forms with sound material and any area where rebound cannot escape or be blown free.

6. Provide a supply of clean, dry air adequate for maintaining sufficient nozzle velocity for all parts of the work and for simultaneous operation of a suitable blow pipe for clearing away rebound.

7. Do not place pneumatically-placed concrete through more than one layer of reinforcing steel rods or mesh in one application unless demonstrated by preconstruction tests that steel is properly encased. Test to see if any void or sand pockets have developed around or behind reinforcement by probing with an awl or other pointed tool after the pneumatically-placed concrete has achieved its initial set; by removal of randomly selected bars; or by coring or other suitable means. In areas where congestion makes the proper placement difficult, the dry method (Gunite) shall be used, or the concrete shall be cast as specified in Section [03300] [03310], ”Cast-In-Place Concrete”.

8. Place pneumatically-placed concrete to provide 1-1/2" minimum cover over reinforcement.

9. Use high tensile ground wires or other accepted means to establish the thickness, surface planes, and finish lines of the pneumatically-placed concrete. Maintain specified tolerances by keeping wires secure and taut.

10. Do not place pneumatically-placed concrete if drying of stiffening of the mix takes place at any time prior to delivery to the nozzle.

11. Do not use previously expended material in the mix; rebounds may be re-used if they conform to the requirements for aggregates, but not in excess of 20% of the total aggregates in any batch.

3.8 PLACING WHERE NO FORMS ARE USED

A. Preparation of Subgrade: All cleaning, excavation, fill, backfill, grading of compacted fill, and disposal of excess earth shall be done prior to the application of pneumatically-placed concrete. The surfaces against which pneumatically-placed concrete are to be applied shall be left in a

thoroughly compacted condition, and shall be neatly trimmed to line and grade. All surfaces shall be wetted before application, but pneumatically-placed concrete shall not be placed on any surface on which free water exists.

B. Minimum Thickness: Minimum thickness shall be as shown on project plans.

C. Reinforcement: Reinforcement shall be as shown; provided, that where welded wire fabric is indicated it shall be spliced as follows: (1) side splices of sheets or roll shall be spliced a minimum of one mesh plus 2 inches; (2) longitudinal splices, or direction of principal stress, shall be spliced a minimum of 2 mesh plus 2 inches. Tie wires shall only be used on cross wires on side splices and on longitudinal wires on end splices.

D. Ground Wires: Ground wires shall be installed in channels or ditches in such a manner that they accurately outline the finished surface of the lining as shown. They shall be located at intervals sufficient to insure proper thickness throughout. Wires shall be stretched tight and shall not be removed prior to application of the finish coat.

E. Headers: Headers shall be installed along the channel where shown. Headers shall be securely fastened to line and grade.

F. Placing: Pneumatically-placed concrete shall be placed in the most expeditious manner as determined by the location of the work. There shall be a nozzleperson's helper in attendance at the nozzle whose duty shall be to move the reinforcement mat sufficiently to permit placing of concrete behind the mat at frequent intervals to insure proper location of reinforcement. In the dry-mix process (Gunite) additional water may be added to the mix when encasing reinforcement to facilitate a smooth flow of material behind the bars. The reinforcing mat shall not be pulled through already placed concrete. Where sides of the channel do not terminate against headers, concrete shall be carried over the side in a berm of not less than the lining thickness, and/or a cut-off wall to prevent moisture seeping under the lining.

G. Finishing: After the concrete has been placed as nearly as practicable to the required depth, the surface shall be checked with a straight edge and any low spots or depressions shall be brought up to proper grade by placing additional pneumatically-placed concrete in such a manner that the finished surface is reasonably smooth. Following this, the surface shall receive a steel trowel finish, unless directed otherwise by the Engineer.

H. Weep Holes: Where weep holes are shown, they shall be installed so that they are flush with the surface of the lining, and open.

3.9 PLACING AGAINST FORMS

A. Forms: Forms shall be of plywood or sheathing and shall be true to line and level. They shall be substantially braced to insure against excessive vibration. Forms shall be built so as to permit the escape of air and rebound and to facilitate the placing of pneumatically-placed concrete. Wall intersections shall be formed in such a manner as to afford a minimum loss of time in pneumatically placing the concrete at the intersection. This may be accomplished by the installation of short removable bulkheads at these points. Columns shall be formed on 2 adjacent sides only where practicable. Forms for beams shall be constructed of a soffit and one side. Where acceptable to the ENGINEER, such forms may be constructed of a soffit form only and a vertical backing of fine wire mesh near the center. Wood beams and shores shall be provided below the soffit in such a manner that no deflection will occur under the load to be superimposed.

B. Forms shall be thoroughly wetted with water prior to application of the concrete.

C. Reinforcement: Reinforcement shall be of the sizes and configuration specified or shown in the Contract Documents. Adequate chairs, ties, or other supports shall be used to maintain the reinforcing in the position required.

D. Ground Wires: Adequate ground wires to be used as screeds shall be installed to establish the thickness and surface planes of the work. Both horizontal and vertical ground wires shall be installed at corners and offsets not clearly established by the form work. In general these will occur at exterior corners, one column or beam corner, water tables, sills, belt courses, etc. Ground wires shall be placed so that they are tight and true to line and in such a manner that they may be easily tightened up. Ground wires shall not be removed until application of the finish coat.

E. Placing: Whenever possible, except when enclosing reinforcing steel, the nozzle shall be held at right angles to the surface and at a distance of 2.5 to 3.5 ft. When enclosing steel, the nozzle shall be held so as to direct the material behind the bars. Each side of each bar shall be shot separately. When enclosing reinforcing steel, a nozzleman's helper equipped with an air blow-out jet shall precede the nozzleman and blow out all rebound, sand, etc., which may have lodged behind the bars. In the dry-mix process (Gunite) additional water may be added to the mix when encasing reinforcement to facilitate a smooth flow of material behind the bars. Pneumatically-placed concrete shall emerge from the nozzle in a steady, uninterrupted flow. When flow becomes intermittent for any cause, the nozzle shall be diverted from the work until the stream again becomes constant. Hydration shall be thorough and uniform without the use of excessive water.

F. In shooting walls or columns, application shall begin at the bottom and the first coat shall completely embed the reinforcement adjacent to the form. The limit of thickness and height shall be determined when the materials begin to sag.

G. In shooting beams, a surface at right angles to the nozzle shall be maintained. Beams, in general, shall not be shot from the top. Where beams are formed of a soffit and a mesh backing at the centerline, they shall be shot from both sides in such a manner that no sags occur.

H. In shooting slabs, the nozzle shall be held at a slight angle to the work so that rebound is blown on to the finished portion where it shall be removed. The air blow-out jet shall be constantly used to keep the work free of rebound. The limit of material to be placed in one layer shall be reached when it begins to show evidence of too much moisture. All loose material or rebound shall be removed from the surface being concreted before placing the next layer. Reinforcement shall be cleaned of any previously deposited concrete which might prevent proper bond to it. Sufficient time shall be allowed between layers for the material to set. Before set has taken place and before placing any succeeding layer, laitance shall be removed by wire brushing. Any laitance which has set shall be removed by sandblasting. Surfaces shall be damp at all times. Rebound pockets, sags, or other defects shall be carefully cut out and replaced with new pneumatically-placed concrete.

I. Finishing: Upon reaching the thickness and planes outlined by forms and ground wires, the surface shall be rodded off to true lines. Low spots shall be built out to proper thickness. Upon completion of rodding, ground wires shall be removed. The finish coat shall be applied starting from the top of walls and working down so that pneumatically-placed concrete is not shot over the finished work. All exposed surfaces shall be finished to straight and true lines, as shown.

J. Finish shall be a steel trowel finish, unless directed otherwise by the Engineer.

3.10 FIELD QUALITY CONTROL

A. The CONTRACTOR will engage a qualified independent testing laboratory acceptable to the ENGINEER to sample materials, visually grade cores, perform tests, and submit reports during pneumatic concrete operations.

B. Air Content: Evaluate per ASTM C 173, volumetric method or ASTM C 231, pressure method. Conduct one (1) test for each compressive-strength test for each mix of air-entrained, wet-mix shotcrete measured before pumping.

C. Pneumatic Concrete Temperature: Evaluate per ASTM C 1064. Conduct one (1) test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one (1) test for each compressive-strength specimens.

D. Test Panels: Prepare a test panel, half of which is reinforced as in the structure, for each mix and for each workday or for every 50 cu. Yd. of pneumatic concrete placed, which ever is less. Produce test panels with dimensions of 24 by 24 inches minimum and of average thickness of pneumatic concrete, but not less than 4-1/2 inches. From each test panel, testing laboratory shall obtain six (6) test specimens: one set of three specimens unreinforced and one set of three specimens reinforced. Test specimens as follows:

1. Test each set of unreinforced specimens for compressive strength according to ASTM C 1140 and construction testing requirements in ACI 506.2.

2. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2

E. In-Place Pneumatic Concrete: Take a set of 3 unreinforced cores for each mix and for each workday or for every 50 cu. Yd. of pneumatic concrete placed, which ever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C 42. Do not cut steel reinforcement – use either pre-placed and/or post-placed techniques and equipment to ensure this requirement is met.

F. Strength of concrete will be considered satisfactory when mean compressive strength of each set of 3 unreinforced cores equal or exceed 75 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.

3.11 CURING

A. Pneumatically-placed concrete shall be damp cured for at least 14 days after placing. Curing shall conform to the applicable requirements of Section [03370], “Curing Concrete”, except as otherwise specified herein. No concrete shall be placed during freezing weather except when proper protective measures are taken as with ordinary concrete work. Concrete shall not be placed against frosted surfaces.

B. When required by the ENGINEER the CONTRACTOR shall provide longer curing times or supplemental methods for curing concrete in structural members, and no additional payment will be allowed therefor.

3.12 CLEANUP

A capable nozzleperson’s helper with an air blow pipe shall be provided to assist the nozzleperson in keeping all rebound, overspray, and other debris out of work area. During work, reinforcement shall be maintained free of loose scale, rust, oil and splatters of previously placed pneumatically-placed concrete and other coatings that may interfere with bonding. Additional workers may be required to take the rebound from the work, if the rebound cannot be removed by the air blow pipe. Upon completion of the work specified in this Section, the CONTRACTOR shall remove all formwork, shoring, rebound, excess material, and protective materials from the project site.

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SECTION 03370
CONCRETE CURING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated on the Drawings and specified herein.

B. This section covers the work necessary for the concrete curing requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03100 Concrete Formwork.

B. Section 03300 Cast-In-Place Concrete.

C. Section 03360 Pneumatically-Placed Concrete.

D. Section 03400 Precast Concrete.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Comply with the reference standards and Standard Specifications of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards, as applicable.

1. Federal Specifications:

   UU-B-790A (Int.Amd. 1) Building Paper, Vegetable Fiber (Kraft, Waterproofed, Waterproofed, water Repellant and Fire Resistant)

2. Commercial Standards:

ACI 308	Standard Practice for Curing Concrete
ASTM C 156	Test Method for Water Retention by Concrete Curing Materials
ASTM C 171	Specifications for Sheet Materials for Concrete Curing
ASTM C 309	Specifications for Liquid Membrane-Forming Compounds for Curing Concrete

3. Government Standards:

CSS	Caltrans Standard Specifications

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the GENERAL REQUIREMENTS.

1.5 QUALITY ASSURANCE

A. Quality Control Data:

1. Curing Compound: Manufacturer's Certification of Compliance, to include statement that product meets ASTM C 309**,** additional permeability requirement, and coverage.

2. Retardant For Exposed Aggregate Finish on Formed Surface: Manufacturer's Certification of Compliance including statement that product is suitable for and will meet job requirements.

3. Curing method, procedures and method of application to be used shall be in compliance with the requirements as specified herein.

PART 2 -- PRODUCTS

2.1 CURING MATERIALS

A. Materials for curing concrete as specified herein shall conform to the Standard Specifications and the following requirements:

1. Polyethylene sheet for use as concrete curing blanket shall be white and conform to ASTM C 171. The loss of moisture when determined in accordance with the requirements of ASTM C 156 shall not exceed 0.055 grams per square centimeter of surface.

2. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (Int. Amd. 1). The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.

3. Polyethylene-coated burlap for use as concrete curing blanket shall conform to ASTM C 171. The loss of moisture, when determined in accordance with the requirements of ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

4. Curing mats for use in Curing Method 6 as specified herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4-inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

5. Evaporation retardant shall be a material such as Confilm as manufactured by Masterbuilders, Cleveland, OH; or an approved equal**.**

B. Curing Compound:

1. Curing compound shall consist of a liquid which, when applied to fresh concrete by means of a spray gun, will form an impervious membrane over the exposed surfaces of the concrete.

2. The membrane may be either asphaltic or paraffin derivatives to which other waterproofing materials may have been added. Concrete curing compounds shall be designated by type as follows:

Type 1 – Clear or translucent without dye

Type 1-D - Clear or translucent with red fugitive dye

Type 2 - White pigmented

Type 3 - Light gray pigmented

Type 4 - Black pigmented

3. Provide curing compound meeting requirements of ASTM C 309, with additional requirement that permeability not exceed 0.039 gm/square cm/72 hours, when tested in accordance with ASTM C 156 standards.

4. Provide evaporation retardant where required to prevent rapid evaporation of water from fresh exposed concrete.

5. When pigmented curing compounds are used, at the time of use, the compound shall be thoroughly mixed, with the pigment uniformly dispensed throughout the mixture.

6. Unless otherwise specified, Type 1-D curing compound shall be used, except that Type 2 shall be used for the top surface of bridge decks.

2.2 FLOOR HARDENER (SURFACE-APPLIED)

A. Floor hardener shall be a colorless, aqueous solution of zinc and/or magnesium fluosilicate.

B. Each gallon of fluosilicate solution shall contain minimum of 2 pounds of crystals.

C. All hardeners shall be furnished by the CONTRACTOR and shall be delivered ready mixed in sealed original containers bearing the manufacturer's name and product identification.

PART 3 -- EXECUTION

3.1 CURING OF CONCRETE

The top surface of highway bridge decks shall be cured by both the curing compound method, and by the water method except that the curing compound shall be either Pigmented Curing Compound-Chlorinated Rubber Base Type (State Specification 8030-71D-04), or Pigmented Curing Compound Chlorinated Rubber Base white or Tinted (State Specification 8030-71D-05), or as directed by the Engineer.

3.2 CURING AND DAMPPROOFING METHODS

General: All concrete shall be cured for not less than 10 days after placing, in accordance with the methods specified herein for the different parts of the work, and described in detail in the following paragraphs. Curing concrete for bridge structures shall comply with Section 90-7 of the CSS.

Surface to be Cured or Dampproofed (except bridge structures)	Method
Unstripped forms	1
Wall sections with forms removed	6

Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3
All concrete surfaces not specifically provided for elsewhere in this Paragraph	4
Floor slabs on grade	5
Roof and slabs not on grade	6
Floor slabs to be covered with resilient flooring	8
Exterior buried surfaces of roof slabs and basement walls	7
All liquid and water retaining structures	2

Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removed. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 10 days of placing the concrete, curing shall be continued in accordance with Method 6, herein.

Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

Method 3: The surface shall be covered with moist earth not less than 4 hours, nor more than 24 hours, after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

Method 4: The surface shall be sprayed with a liquid curing compound.

1 Curing compound shall be applied in 2 coats according to the manufacturer's printed instructions. The direction of application of the second coat shall be perpendicular to the first. The second coat shall be applied when the first coat is dry to touch, but not to exceed 4 hours. Each coat shall be applied at a rate not more than 200 square feet per gallon and in such a manner as to cover the surface with a uniform film which will seal thoroughly.

2 Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. The CONTRACTOR shall maintain and monitor the curing compound membrane for a minimum of 10 days. Should the seal be damaged or broken before the expiration of this curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

3 Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

4 Application of the curing compound to the concrete shall commence as soon as the finished surface of the concrete reaches a uniformly damp appearance with no free water on the surface. Curing compound shall also be applied no later than 2 hours after removal of forms from contact with formed surfaces or after the placement of concrete on the subgrade. At any point, the application rate shall be within 50 square feet per gallon of the nominal rate and the average application rate shall be within 25

square feet per gallon of the nominal rate specified when tested in accordance with California Test 535.

5 Repairs required to be made to formed surfaces shall be made within the said 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified herein.

6 At the time of use, pigmented curing compounds shall be maintained in a thoroughly mixed condition. Containers of curing compound shall remain air-tight when not in use.

7 The CONTRACTOR shall apply curing compound in the presence of the INSPECTOR. Curing compound shall be applied to form a continuous and uniform membrane.

Method 5: Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying shrinkage cracks.

1. Immediately after each square foot of the concrete has been finished, it shall be given a coat of curing compound in accordance with Method 4, herein. Not less than one hour nor more than 4 hours after the coat of curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting or polyethylene-coated burlap. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3-inches and fastened together with a waterproof cement to form a continuous watertight joint.

2. The curing blankets shall be left in place during the 10-day curing period and shall not be removed until after concrete for adjacent work has been placed. Should the curing blankets become torn or otherwise ineffective, the CONTRACTOR shall replace damaged sections. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The CONTRACTOR shall add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

Method 6: Concrete slabs shall be treated with an evaporation retardant as specified in Method 5. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 10 consecutive days beginning immediately after the concrete has been placed or forms removed. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held in place to prevent being dislodged by wind or any other causes. Until the concrete surface is covered with the curing medium the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed and curing compound immediately applied in accordance with Method 4, herein. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the work.

Method 7:
1. Method 6 shall be used for curing.

2. Immediately after completion of curing the surface shall be sprayed with a dampproofing agent consisting of an asphalt emulsion. Application shall be in 2 coats. The first coat shall be diluted to 1/2 strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the specified material, undiluted, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Dampproofing material shall be as specified herein.

3. As soon as the asphalt emulsion, applied as specified herein, has taken an initial set, the entire area thus coated shall be coated with whitewash. Any formula for mixing the whitewash may be used which produces a uniformly coated white surface and which so remains until placing of the backfill. Should the whitewash fail to remain on the surface until the backfill is placed, the CONTRACTOR shall apply additional whitewash.

Method 8: Floor slabs to be covered with resilient flooring shall be coated with an asphaltic membrane curing compound such as Hunt's Process Black, or an approved equal.

3.3 EVAPORATION RETARDANT APPLICATION PROTECTION

A. Spray onto surface of fresh concrete immediately after screeding to react with surface moisture.

B. Reapply after smoothing surface with a bull float to ensure continuous, compacted monomolecular layer until final finishing is completed.

C. After finishing, apply water curing as specified.

3.4 CURING AND PROTECTION IN COLD WEATHER

A. Concrete shall not be placed during cold weather where conditions would require procedures as specified in ACI 306.

B. The Engineer, at his option, may allow cold weather placement of concrete if an extended period of cold weather is anticipated.

C. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.

D. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise, the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water curing shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.

E. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

F. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

3.5 CLEAR HARDENER APPLICATION (SURFACE APPLIED)

A. Before application, thoroughly cure floors to receive hardener for minimum 28 days, keep clean, unpainted, free from membrane curing compounds, and dry with all work above them completed.

B. Do not use curing compounds where floor hardeners are specified. Use water curing only.

C. Apply hardener evenly, using three coats, allowing 24 hours between coats as follows:

1. First Coat: 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength, mix with water.

2. Apply each coat so as to remain wet on surface for 15 minutes.

3. Apply approved hardeners in accordance with manufacturer's instructions.

4. After final coat is completed and dry, remove surplus hardener from surface by scrubbing and mopping with water.

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SECTION 03400
PRECAST CONCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the precast concrete work in accordance with the Contract Documents.

B. This Section covers the design, fabrication, delivery and installation of all plant precast concrete units, including connections, complete, in place, as shown and specified.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03315 Grout.

B. Section 07900 Joint Sealants.

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Comply with reference standards of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards, ~~or~~ as applicable:

1. Commercial Standards:

ACI 301	Specifications for Structural Concrete
ACI 304	Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 311	Guide for Concrete Plant Inspection and Testing of Ready-Mixed Concrete
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
ACI 347	Guide to Formwork for Concrete
AWS A5.4	Welding Rods and Electrodes
AWS D1.1	Welding and Cutting
AWS D1.4	Structural Welding Code – Reinforcing Steel
ASTM A 184	Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement

ASTM A 193	Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 351	Specification for Steel Castings, Austenitic, for High-Temperature Service
ASTM A 497	Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A 580	Specification for Stainless and Heat-Resisting Steel Wire
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 666	Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications
ASTM A 775	Specifications for Epoxy-Coated Reinforcing Steel Bars
ASTM C 33	Specification for Concrete Aggregates
ASTM C 67	Method for Sampling and Testing Brick and Structural Clay Tile
ASTM C 127	Test Method for Specific Gravity and Absorption of Coarse Aggregate
ASTM C 128	Test Method for Specific Gravity and Absorption of Fine Aggregate
ASTM C 150	Specification for Portland Cement
ASTM C 173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 204	Test Method for Fineness of Portland Cement by Air Permeability Apparatus
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete
ASTM C 311	Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 494	Test Method for Shear Fatigue of Sandwich Core Materials
ASTM D 2240	Test Method for Rubber Property -- Durometer Hardness

AWS B2.1	Specification for Welding Procedure and Performance Qualification
AWS D1.4	Structural Welding Code - Reinforced Steel
PCI MNL-116	Manual for Quality Control for Plants and Production of Structural Precast Concrete Products
PCI MNL-117	Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products
PCI MNL-121	Manual for Structural Design of Architectural Precast Concrete

2. Government Standards:

CSS	Caltrans Standard Specifications.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the GENERAL REQUIREMENTS.

B. Shop Drawings:

1. Shop drawings shall provide details in accordance with ACI 315 and ACI 318 including installation details.

2. Shop drawings, including design computations, shall be stamped and signed by a civil or structural engineer registered in the State of California and shall be approved by the ENGINEER.

3. Shop drawings shall indicate precast unit identification marks, location of units in the WORK, elevations, fabrication details, welding details, reinforcement, connections, dimensions, interface with adjacent members, and special handling instructions in sufficient detail to cover manufacture, handling, and erection. Shop drawings shall include erection drawings. Shop drawings shall also include design computations for above mentioned drawings.

4. Shop drawings shall be divided into complete separate submittals for each structure. Each complete submittal shall consist of a panel schedule and shop drawings.

a. Panel Schedule: Showing all exterior elevations of the structure, including all precast concrete enclosure faces exposed to view, in its associated shop drawing submittal. Elevations at a minimum scale of 1/8" = 1'-0" shall be drawn, identifying the type and location of each panel by a number which corresponds to the panel number appearing on an associated shop drawing; this same number shall be permanently marked on the back of each panel as they are fabricated.

b. Shop Drawings: Showing all elevations, dimensions, horizontal and vertical sections, openings, inserts, reinforcing, anchorage devices, pick-up points, details, design computations, and other requirements for each different type of panel to be incorporated into the portion of the project covered by the submittal. Drawings shall be 24 inches x 36 inches maximum.

c. For bridge structures, shop drawings for precast concrete piles shall conform to Section 49-3 of the CSS.

C. Small Samples:

1. Unless otherwise specified on the contract documents, two 18-inch by 12-inch samples of precast concrete unit finish shall be submitted, as required for the project. Each sample shall show matrix color, surface color, surface texture, and panel back finish.

2. When so requested by the ENGINEER, submit samples of cast-in gaskets, anchorages and other attachments and accessories.

3. The face of each sample shall contain at least two areas of approved size and shape which have been chipped out and then patched and repaired and one form joint; the color, texture and appearance of patched areas and form joint shall match that of adjacent surface.

4. Samples will be inspected for color and texture match to the samples selected by the ENGINEER, uniformity of color and texture throughout the panel and acceptability of patching and joint treatment. Exposed face of samples shall be tested for efflorescence in accordance with ASTM C 67; rating shall not be more than "slightly effloresced."

5. If the ENGINEER rules a sample, or samples, to be unacceptable, the CONTRACTOR shall fabricate and resubmit additional samples at no additional cost to the CITY.

6. When approved, one sample will be kept at the ENGINEER's field office and the other shall be picked up by the CONTRACTOR and returned to the manufacturing plant. These sample panels will be used as a comparison to judge acceptability of the full-size panel samples and, where necessary, the production precast units.

D. Full-Size Panel Samples at Project Site: From the first loads of acceptable panels for the Project, the ENGINEER will select one panel of each texture which is scheduled to be erected in a prominent location. If the ENGINEER chooses, panels may be selected from a later load. The selected panel(s) together with the Small Sample from Section 1.4.C kept at the ENGINEER's field office, will become the jobsite standard against which all panels will be compared.

E. Mix Proportions: Prior to commencing operations, including fabrications of the precast concrete for any mock-up, a statement shall be submitted giving the nominal maximum aggregate size and proportions of all ingredients that will be used in the manufacture of concrete. The statement shall include test results from an approved testing laboratory, with certification stamp and signature by a Civil or Structural Engineer registered in the State of California. No substitutions shall be made in materials used in the concrete mix without approval and additional tests to verify that the concrete properties are satisfactory. A copy shall be submitted of concrete mix with each set of samples.

F. Test Reports: Tests for compressive strength of concrete shall be performed by an approved independent commercial testing laboratory at no cost to the CITY. Copies of test reports including all test data and all test results shall be submitted for review and approval of the ENGINEER.

G. Certificates of Compliance: Certificates of compliance shall be submitted attesting that materials and products meet or exceed specified requirements.

H. Manufacturer's Qualifications: Prior to commencing operations, a statement shall be submitted giving the qualifications of the precast concrete Manufacturer, and evidence that the Manufacturer and plant are PCI certified.

1.5 QUALITY ASSURANCE

A. General Requirements: Design precast members under direct supervision of a professional structural engineer experienced in design of precast concrete units, registered in the State and conforming to requirements of PCI MNL-121 and to ACI 318.

1. Precast Manufacturer and erectors shall be qualified in accordance with PCI MNL-117 and MNL-116.

2. Welding shall be in accordance with AWS D1.1, AWS D12.1, AWS B2.1, and AWS A5.4.

3. Manufacture, Transportation and Installation: The Manufacturer shall specialize in providing precast products and services normally associated with precast concrete construction with high quality architectural finishes similar to that indicated on drawings, using procedures complying with PCI MNL-116 and MNL-117, and PCI plant certified for at least 5 years.

4. Use adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Sample Disposal
1. At the ENGINEER's request, the CONTRACTOR shall dispose off the sample at no cost to the CITY.

1.6 DESIGN REQUIREMENTS

A. General: The precast concrete panel and connection designs shown hereon represent minimum precast construction requirements. The Manufacturer shall verify the panel and connection designs for all handling, erection, and service conditions, and shall provide any additional materials necessary to meet the design conditions.

1. The panel joints shall be designed to accommodate an in-plane movement between stories of 0.005 times the story height in inches but not less than 3/4-inch.

2. Panel connections shall accommodate building movement and permit panels to move freely so as not to resist in plane deformation of the main frame structural system. Adjustment shall be provided to accommodate misalignment of structure without permanent distortion, damage to components, racking of joint connection, breakage of seals, or moisture penetration.

B. Concrete Mix: The concrete mix shall be designed by the Manufacturer, with certification stamp and signature by a Civil or Structural Engineer registered in the State of California, and approved by the ENGINEER, using the materials and quantities specified to meet all of the requirements of this specification.

1. Proportioning of Concrete Mixes: Mixes shall be proportioned by weight except water and admixtures may be batched by volume if desired. Trial mixes and testing to meet requirements of the strengths of concrete specified is the CONTRACTOR's responsibility. Design mix shall contain similar materials as those proposed for use in the WORK.

2. Admixtures: Concrete shall contain an air entraining admixture in proportion so as to provide 4 percent plus or minus 1 percent total air in the concrete as determined by

ASTM C 173 or C 231. Set retarding admixtures may be used provided cement content is not reduced. Water reducing admixtures may be used provided they are used in the mix design studies. High-range water reducers (superplasticizers) shall be used only where specifically called for in this Section, otherwise superplasticizers shall not be used without written approval from the ENGINEER. No admixture may contain chlorides, bromides, or fluorides.

3. Water: Clean, potable water. The CONTRACTOR shall provide tests to assure that no more than 200 parts per million total aggregated content of chlorides, bromides, and fluorides are present.

4. If a variance from the Local Authority is required for the precast concrete mix design, the CONTRACTOR shall be responsible for submitting and obtaining the 5,000 psi precast concrete mix variance. The admixtures used in the mix design shall be used in approved combinations and proportions in accordance with the local requirements.

C. Formwork: Formwork shall be designed to withstand high-frequency vibration and to ensure finished units.

D. Pickup Points and Boxouts: Pickup points, boxouts, and inserts on panel faces and surfaces to be exposed are prohibited except as approved by the ENGINEER.

1.7 DELIVERY, STORAGE AND HANDLING

A. General: Deliver precast concrete units to the job-site in such quantities and at such times as to assure the continuity of construction. Precast members shall be handled to position consistent with their shape and design; they shall be lifted and supported from design incorporated support points and provided with strong backs and other devices as required. Lifting or handling equipment shall be capable of maintaining units during manufacture, storage, transportation, erection, and in position for fastening.

B. Blocking and supports, lateral restraints and protective materials during transport and storage shall be clean, nonstaining, without causing harm to exposed surfaces, including temporary support to prevent bowing and warping. Lateral restraints shall be provided to prevent undesirable horizontal movement. Edges and exposed faces of members shall be protected to prevent straining, chipping, or spalling of concrete.

C. Units shall be marked with date of production and final position in structure in location not visible after erection.

D. Precast units shall be stored off the ground in a manner to keep markings visible, and to prevent cracking, distortion, warping, staining or other physical damage, and they shall be protected from weather, marring, and overload.

E. Stainless Steel Hardware: Stainless steel hardware shall be transported, handled, stored, and protected in wood crates.

PART 2 -- PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type II, "low alkali," white color. "Low alkali" requirement may be waived if not reactive as defined in Appendix to ASTM C 33. Submit laboratory test reports.

B. Aggregate: ASTM C 33, 1/2-inch maximum coarse aggregate size fine aggregate ratio to total aggregate volume = 0.35 min, 0.55 max.

1. Water Absorption, Coarse Aggregate: ASTM C 127.

2. Water Absorption, Fine Aggregate: ASTM C 128.

C. Reinforcing Steel: ASTM A 615, Grade 60, deformed epoxy coated in accordance with ASTM A 775.

D. Welded Wire Fabric:

1. Plain: ASTM A 185, epoxy coated.

2. Deformed Steel: ASTM A 497, epoxy coated.

3. Fabricated Steel Bar or Rod Mats: ASTM A 184, epoxy coated.

E. Tie Wire: ASTM A 580, Type 316L, cold finished annealed, "Monel", "Inconel", or an approved equal.

F. Air Entrainment Admixture: ASTM C 260.

G. Water Reducing or Retarding Admixtures: ASTM C 494, Type C, D, or F/G, with no chloride, bromide, and fluoride ingredients. Use Pozzolith 300-R manufactured by Master Builders, Plastiment manufactured by Sika Chemical Corp., or an approved equal.

H. Silica Fume Slurry Admixture: 45 to 50 percent silica fume, water, and superplasticizer as dispersant. Silica Fume: 85 percent amorphous silicon dioxide in accordance with ASTM C 311; loss on ignition shall not exceed 6 percent and moisture shall not exceed 3 percent in accordance with ASTM C 311. Surface area not less than 10,000 square meters per kilogram at bed porosity of 0.50 in accordance with ASTM C 204.

Reduce water in mix by 5.6 to 9.5 lbs for each gallon of slurry added to mix, as recommended by slurry Manufacturer used.

I. Pigment: Pure mineral type, color-resistant to alkalis, nonfading. Color as required to produce finished concrete matching color and appearance of prebid sample and the 72-inch by 72-inch sample at the ENGINEER's field office.

2.2 SUPPORT DEVICES

Unless otherwise specified on the project plans, the following requirements shall apply:

A. Connecting and support devices, bolts, nuts, washers, inserts, and anchorage devices exposed to view, moisture, or weather shall be hot-dipped galvanized steel.

B. Anchorage devices shall be fabricated from ASTM A 36, and shall be hot-dip galvanized in accordance with ASTM A 123.

2.3 ACCESSORIES

Unless otherwise specified on the project plans, the following requirements shall apply:

A. Plates, Angles, Anchors, studs, and other metal accessories exposed to view, moisture, or weather shall be hot-dipped galvanized steel.

B. Reglets: Plastic, shaped and flanged to remain in place once cast; tape closed to prevent concrete intrusion.

C. Bearing Pads: Neoprene, molded to size or cut from molded sheet, 70-80 Type A durometer, ASTM D 2240.

D. Gaskets: ASTM C 509, preformed, firm, cellular, neoprene, sized to be under constant compression at the joints, and manufactured in lengths to minimize field splices.

2.4 FORMS AND MOLDS

A. Forms: Manufacturer's standard with smooth, hard, dense, and rigid casting surface; without bow, warpage, oil canning, or other imperfections. Comply with PCI MNL 117, Division V, Section 2, Article 5.2.1.

B. Form Release Agent: Manufacturer's standard, nonstaining, nonpetroleum based; compatible with concrete surface sealer.

C. Surface Sealer: Clear, flat, penetrating, nonyellowing, nonclouding solution; high concentration of organosilane in an aqueous alcoholic vehicle which is designed to provide water repellent concrete surfaces from which graffiti can be easily removed. Oil-type silicones, paraffins, waxes, vinyls, modified urethanes, or acrylics shall not be used. Sealant shall be tested by Manufacturer and proved compatible with surface sealer.

D. Molds: Fabricate using steel, concrete, fiberglass, reinforced plastic or wood.

a. Selection of materials for molds shall be at manufacturer's option, except that wood shall not be use without specific prior approval of the ENGINEER.

b. Cast elements in molds of rigid construction, accurate in detail with precise corners and arises, and designed to provide close control of dimensions, radii, and details as indicated on the Contract Drawings.

c. Prior to casting of precast elements, molds shall have surface joints, radii, and corners filled, ground, filed, straightened, or otherwise removed to provide finished concrete surface that is smooth and dense, free of honeycombing, air pockets, offsets, sinkages, or other irregularities.

d. Mold Release Agents: Synthetic resin or organic compound containing no wax, oil, silicates, or varnish, and compatible with specified coatings, sealants, fresh concrete, curing process, and adhesives.

e. Cast molds with release agents to facilitate removal of elements from molds.

2.5 MIX

Silica Fume Concrete: Minimum 4,000 psi (unless noted otherwise on the project plans), 28-day compressive strength; aggregate 3/8-inch max; water - 305 lbs per cu yd; cement - 750 lbs per cu yd; w/c ratio 0.40 max; slump range 3 inches to 5 inches with silica fume slurry; air entrainment 4 percent plus or minus 1 percent; 7.5 percent dry silica fume by weight of cement, provided through specified silica fume slurry; add superplasticizer to achieve desired working slump for precast concrete as may be required by silica fume slurry Manufacturer. Add colorant as required to achieve match with ENGINEER's sample. Moist cure by spray mist.

2.6 FABRICATION

A. General: Precast concrete units shall be fabricated by a licensed shop in accordance with ACI 318, PCI MNL-116 (structural features), PCI MNL-117 (nonstructural features, surface treatments, patching, and tolerances). Plant records and quality control program shall be maintained during production of precast units. Records and access to plant shall be available to the ENGINEER upon request.

Rigid molds shall be used, constructed to maintain precast unit uniform in shape, size, and finish, free from castings and dents, gouges, oil canning, or other irregularities that will adversely affect appearance or strength of units. Consistent quality shall be maintained during manufacture.

Equipment for handling epoxy-coated reinforcing bars shall have protected contact areas. Bundles of coated bars shall be lifted at multiple pickup points to prevent bar-to-bar abrasion from sags in the bundles. Coated bars or bundles of coated bars shall not be dropped or dragged. Coated bars shall be stored on protective cribbing. The maximum amount of damage shall not exceed 2 percent of the surface area of each bar.

Reinforcing steel, anchors, inserts, plates, angles, and other cast-in-place items shall be embedded as indicated on shop drawings. Reinforcement shall be fabricated and placed in conformance with ACI 318. No tack welding of or to reinforcement permitted. Welding when allowed shall conform to AWS D1.4 requirements. No carbon steel chairs, spacers, nails or tie wire shall be used in positioning reinforcing and embedments.

Adequate reinforcing steel shall be provided to control cracking. Maximum permissible crack width:

Surfaces exposed to weather:	0.005 inch.
Surfaces exposed to view but not weather:	0.01 inch

Connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories shall be fabricated to permit initial placement and final attachment.

Anchors, inserts, lifting devices, and other accessories shall be placed and embedded in accordance with approved shop drawings, accurately positioned in their designed location and anchored to prevent dislocation during panel construction. Do not use powder actuated fasteners for surface attachment of accessory items except as specifically approved by the ENGINEER and specifically accepted by the precast unit manufacturer. Flashing reglets shall be placed and embedded continuous and straight, with lifting devices to permit removal after erection.

Units shall be moist cured with water mist to develop concrete quality and to minimize surface drying and appearance blemishes such as nonuniformity, staining, or surface cracking.

Precast units shall be removed from formwork using procedures conforming to PCI MNL-117. Minor patching in plant acceptable, providing structural adequacy and appearance of units are not impaired. Each precast unit shall be identified with corresponding code on erection drawings, in location not visible to finished work.

Repair of damaged epoxy coating, when required, shall be made with patching material conforming to ASTM A 775. Repair shall be in accordance with the material Manufacturer's recommendations.

B. Fabrication and Tooling of Stainless Steel Connections and Embedments: All tools used during fabrication shall be made of stainless steel. Use of carbon steel tools is prohibited.

Welding of stainless steel shall conform to AWS A5.4, AWS B2.1 and AWS D1.1, using tungsten inert gas procedures and 316L filler metal for stainless steel to stainless steel and 309 filler metal for stainless steel to carbon steel. Surfaces shall be sanded smooth (do not grind), and oxidized discoloration removed (blue heat tint). Threaded parts of stainless steel bolts shall be lubricated with graphite suspended in alcohol (Neo-Lube) every time that nut is run on or off the threads. No other lubricant is acceptable.

Erection slings, cables, blocking, hardware and restraints shall be nonmetallic or stainless steel. Cribbing or crating shall be wood.

2.7 FINISH OF PRECAST UNITS

A. Backs and Sides (Unexposed Edges): Smooth, dense, uniform surface free from blemishes. Defects in backs and sides (unexposed edges) shall be repaired as approved.

B. Faces: Appearance, color, and texture finish of all panels shall match appearance, color and texture of the approved sample panels constructed by the CONTRACTOR. Panels that do not match shall be rejected. Repairs will be acceptable only if structural adequacy and appearance of product are not impaired and the repair and surrounding area match the approved sample panels at the ENGINEER's field office.

Mechanical finishing of panels at precast plant shall be at essentially the same age (or strength) of concrete to assure finished appearance is uniform from panel to panel.

To reduce possibility of stains occurring during transportation and erection, sealer shall be applied at the plant as recommended by Manufacturer and the precaster and shall be guaranteed in writing that sealer will not alter or yellow the original precast concrete color in any way and that it is compatible with the joint sealants to be used on the project. Seal finish surfaces of precast units to be exposed in completed work as follows: apply a uniform coat of surface sealer in accordance with Manufacturer's written instructions. Apply sealer by method and in quantity required to provide coverage specified by sealer Manufacturer. Forty-eight hours after application of sealer, apply water to face of each panel in sufficient quantity to determine if full sealer coverage was achieved. Panels not fully sealed shall be resealed and retested. A second coat shall be applied at the jobsite after erection and cleanup in accordance with the Manufacturer's instructions.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Examination: The CONTRACTOR shall verify that the structure, anchors, devices, and openings are ready to receive work of this Section. Beginning of installation means acceptance of existing condition.

B. Preparation: The CONTRACTOR shall provide for erection procedures and induced loads, during erection, maintain temporary bracing in place until final support is provided, provide necessary hoisting equipment and safety and protective devices.

C. Erection: The units shall be erected in accordance with approved shop/erection drawings without damage to shape or finish or adjacent work. Damaged panels shall be replaced or repaired. Unless otherwise shown, members shall be erected level and plumb within allowable tolerances.

The CONTRACTOR shall align and maintain uniform horizontal and vertical joints as erection progresses, provide approved shims and wedges as required, and when members required adjustment beyond design or tolerance criteria, discontinue affected work. Units shall be secured in place and field welds, scratches and otherwise damaged steel surfaces shall be touched up.

Field fabrication and erection of stainless steel shall conform to the procedures outlined in the paragraph entitled "Fabrication and Tooling of Stainless Steel Connectors and Embedments."

The vertical units shall be set dry, without grout, attaining joint dimension with lead or plastic shims and spacers.

Pickup points, boxouts, inserts, bearing surfaces, and open spaces at connections and joints shown shall be grouted with non-shrink grout system(s) recommended by the manufacturer of the precast units, in accordance with Section [03315], "Grout". The color and texture of concrete surfaces of adjacent areas shall be finished to match in the same plane. Provide forms or other acceptable method to retain the grout in place until it is sufficiently hard to support itself. Pack spaces with stiff grout material, tamping voids completely full. Place the grout in a manner to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted surfaces damp for not less than 24-hours after grout has taken its initial set. Promptly remove grout material from exposed surfaces before its hardens.

D. Tolerances: In accordance with requirements of PCI MNL-117 unless otherwise indicated.

1. Variation from Plane of Location: 1/4-inch in 10 feet and 3/8-inch in 100 feet maximum, compensating not cumulative.

2. Offset from True Alignment between Two Connecting Members: 1/4-inch maximum.

3. Out of Square: 1/8-inch in 10 feet maximum, noncumulative.

4. Variation in Dimensions Indicated in Shop Drawings: Plus or minus 1/8-inch.

5. Misalignment of Anchors, Inserts, Openings: 1/8-inch, maximum.

6. Bowing or Warpage of Units: 1/700 of panel dimension.

7. Exposed Joint Dimension: 3/4-inch plus or minus 1/8-inch.

8. Location of Reglets: 1/4-inch from true position.

3.2 CLEANING

A. Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of precast units shall be cleaned using a cleaning detergent recommended by the sealer manufacturer and water applied with a soft bristle brush, and thoroughly rinsed using clean water or other approved procedures.

B. Units shall be cleaned when temperature and humidity conditions are such that surfaces dry rapidly (e.g., 70 degrees F and rising, 50 percent Relative Humidity or less).

C. Discolorations which cannot be removed by these procedures shall be considered defective work, and repaired or replaced as directed by ENGINEER.

D. Just before final acceptance by the ENGINEER, clean precast units to remove dirt and stains.

3.3 PROTECTION

Adjacent surfaces shall be protected from damage during sealing and cleaning operations and against damage, disfiguration or discoloration from subsequent operations. Noncombustible shielding shall be used during welding operations.

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SECTION 05120
STRUCTURAL STEEL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide all labor, tools, material, and equipment necessary so as to furnish, fabricate, and install, the structural steel framing and all appurtenant metal parts required for permanent connection of the structural steel, complete, all in accordance with the requirements of the Contract Documents. The CONTRACTOR shall also design all temporary construction braces and sequences of erection.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. The WORK of the following Sections or Divisions applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 03315 Grout

2. Section 05500 Miscellaneous Metalwork

3. Section 09800 Protective Coating

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Comply with reference standards and Standard Specifications of the GENERAL REQUIREMENTS.

B. Comply with the following American Institute of Steel Construction (AISC) references, as applicable:

1. AISC 303-05**]**, "Code of Standard Practice for Steel Buildings and Bridges."

2. AISC "Steel Construction Manual", Thirteenth Edition

3. ANSI/AISC 360-05, "Specification for Structural Steel Buildings"

4. ANSI/AISC 341-05 "Seismic Provisions For Steel Buildings" and including the "Commentary"

5. ANSI/AISC 358-05 "Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications"

C. Comply with the current provisions of the following American Welding Society (AWS) Codes and Specifications, as applicable:

1.	AWS B2.1	Specification for Welding Procedure and Performance Qualification
2.	AWS D1.1	Structural Welding Code – Steel
3.	AWS D1.8	Structural Welding Code – Seismic Supplement

D. Comply with the current references of the American Society for Nondestructive Testing, Inc.

1.	SNT TC-1A	Recommended Practice – Personnel Qualification and Certification in Nondestructive Testing.
2.	ANSI/ASNT CP-189	Standard for the Qualification and Certification of Nondestructive

Testing Personnel.

E. Comply with the Research Council on Structural Connections (RCSC) “Specification for Structural Joints Using ASTM A325 or A490 Bolts”, as applicable.

F. Comply with the current provisions of the following Codes and Standards, as applicable:

1. American Society of Testing & Materials (ASTM)

ASTM A36	Standard Specification for Carbon Structural Steel
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A193	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A354	Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
ASTM A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
ASTM A490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength. Conform to -08a or later revisions when Zinc coating is required
ASTM A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572	Standard Specification for High Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.

ASTM A992 Standard Specification Steel for Structural Shapes For Use in Building Framing

ASTM E709 Standard Guide For Magnetic Particle Testing

ASTM F436 Standard Specification for Hardened Steel Washers

ASTM F959 Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

ASTM F1554 Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

ASTM F1852 Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM F2280 Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength

2. Government Standards:

City of Los Angeles, Department of Building and Safety (LADBS) applicable Information Bulletins

City of Los Angeles, Department of Building and Safety, "Standard Quality Assurance Plan for Steel Moment Frames"

CSS Caltrans Standard Specifications

GWP Global Warming Potential (maximum acceptable carbon emission limits, established by the California Department of General Services)

3. Trade Standards and References:

SP-1 "Solvent Cleaning", by the Steel Structures Painting Council, SSPC (also known as The Society of Protective Coatings).

SP-2 "Hand Tool Cleaning" by the Steel Structures Painting Council, SSPC.

SP-3 "Power Tool Cleaning", by the Steel Structures Painting Council, SSPC.

1.4 CONTRACTOR SUBMITTALS

A. General Requirements

1. Submittals shall be made in accordance with the GENERAL REQUIREMENTS (GR), and include the items indicated herein, and prepared in advance of fabrication, erection, and before incorporated into the work, for review and acceptance by the ENGINEER.

2. Buy Clean California Act.

a. For project specifications that include GR Section 1601, Buy Clean California Act, bidders shall submit current Environmental Product Declarations (EPDs) for each of the following structural steel: hot-rolled sections, hollow structural sections, and plates, from the originating mill used in the project as well as the corresponding mill certifications.

When material comes from different mills, an EPD and mill certification will be required for each mill from which the material has been obtained.

b. An EPD must conform to the following:
   1) Shall be facility-specific manufacturer/mill EPD.
   2) Be independently verified in accordance with ISO 14025 (Type III).
   3) Be developed according to the guidelines of the applicable Product Category Rule (PCR), as identified by the Department of General Services, State of California.
   4) Have a valid date that has not expired.
   5) Shall not exceed the Global Warming Potential (GWP) limit as required by GR Section 1601.

c. EPD shall be submitted concurrently with the product's submittal for review and approval.

B. Certifications and Proof of Qualifications from the following:

1. Fabricator and erector: All structural steel fabrication shall be performed in a Los Angeles Department of Building and Safety (LADBS) licensed fabricator shop for structural steel

2. Shop and field welders: All welding shall be performed by welders certified by LADBS for structural steel.

3. Testing laboratory and technician conducting any of the required tests

4. Non-destructive testing (NDT) technician

5. Shear connector manufacturer authorization for each Installer/Operator

C. Product Data:

1. Submit fabricator's or manufacturer's certification, specifications, recommended installation instructions, laboratory test reports, and all other data required to prove compliance with these specification requirements for the following items.

   a. Structural steel, including certified copies of mill test reports covering chemical and physical properties.

   b. High strength bolts, including nuts and washers, and RCSC related specification.

   c. Unfinished bolts and nuts

   d. Shear connectors and corresponding welding equipment approval by LADBS

   e. Structural steel primer paints and finish coatings

2. Shop drawings shall include Bill of Material with total weight of all fabricated steel, all shop and erection details showing all members and their connections, shear connectors, anchor bolt layouts, schedules for fabrication procedures, and diagrams showing the sequence of erection. In addition, the following requirements shall be met:

   a. Members and connections for any portion of the structure not shown on the contract drawings shall be detailed by the fabricator and indicated on the shop drawings.

   b. Include details of cuts, connections, camber, holes, and other pertinent data, as well as items needed for other work; list types of paints and finish coatings, which are compatible.

   c. All welds shall be indicated by standard welding symbols of the AWS. Show location,

size, type, and length of welds. Clearly distinguish between shop and field welds.

d. All bolts and corresponding holes shall be called out. Show location, size, type, and identify pretensioned and slip-critical high strength bolted connections including the amount of tensioning required.

e. For connections containing a combination of bolts and welds, indicate sequence of installation between the two connector types.

f. Shop drawings shall show reference marks and cross references to drawings.

g. Fabricator shall be responsible for correct interpretation of the contract drawings and shall call to the ENGINEER's attention any discrepancies found.

h. No deviation shall be made from the contract drawings without prior approval of the ENGINEER in writing.

i. Provide setting drawings, templates and directions for installing anchor bolts and other required anchors.

j. Identify locations of welded and/or bolted connections which require necessary testing.

k. All framing shop drawings shall include final flooring, roofing, parapet and any other relevant elevations.

D. The CONTRACTOR shall submit an erection plan for the structural steel framing that includes drawings and procedures. This erection plan shall conform to the requirements of the AISC “Code of Standard Practice for Steel Building and Bridges”. The erection plan shall include shoring and bracing drawings and describe all necessary temporary supports, including the sequence of installation and removal. Submittal shall be prepared and signed by a California licensed civil or structural engineer and be in accordance with Cal OSHA regulations.

E. Test Reports: Submit reports of tests conducted on shop and field welds and bolted connections, including data on type of tests conducted and test results.

F. Welding procedure specifications and welding procedure qualification tests, including those for weld repair, shall be submitted to and approved by the ENGINEER, in triplicate.

G. Documentation and information required in relevant AISC references, including Appendix Q and W of “Seismic Provisions for Steel Buildings.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Fabricator: Company specializing in the fabrication of the work in this Section shall have a minimum 5-year documented experience. Fabricator shall be a City of Los Angeles Department of Building & Safety (LADBS) licensed/certified Fabricator Shop. When work involves high strength steel, fabricator shall also show proof of compliance with LADBS Information Bulletin P/BC 2008-032 or latest revisions.

2. All welders, including, shop welders, shall be City of Los Angeles Department of Building & Safety (LADBS) certified welders, in the classification of the work being performed.

3. Erector: Company specializing in the installation of the work of this Section shall have a minimum 5-years documented experience.

4. Technicians performing non-destructive testing (NDT) shall be Certified Level II Technicians in accordance with the American Society for Non-destructive Testing (ASNT)’s references.

Certification shall be for the particular NDT being performed.

B. Inspection:

1. Quality Control is the responsibility of the CONTRACTOR for its forces and those of its Subcontractors. Inspection will be provided by the City in accordance with “INSPECTION OF THE WORK” of the GENERAL REQUIREMENTS.

2. Schedule and coordinate with the INSPECTOR all necessary tests, special inspection, and overall general quality assurance inspection.

3. Inspection by Others: Schedule and coordinate all necessary tests, inspections, and quality control services with the authorities having jurisdiction, including the Department of Building and Safety and notify the INSPECTOR that such activity is taking place.

4. If, after fabrication and inspection, the work of this Section is found to be defective and to require re-inspection, cost of such re-inspection will be paid by the CONTRACTOR.

5. Provide labor, equipment, and facilities needed to move and handle the materials to be inspected.

6. Provide access for the testing agencies and inspectors to locations where structural steel work is being fabricated or produced, so that required testing and inspection may be accomplished.

C. Shop Inspection, Fabrication and Tests.

1. Quality Control is the responsibility of the CONTRACTOR for its forces and those of its Fabricators/Subcontractors. As a minimum, conform to Section 8 of AISC’s Code of Standard Practice, and when high strength steel is required in the work, conform to LADBS Information Bulletin P/BC 2008-032 or latest revision.

2. Shop Inspection shall be in accordance with “SAMPLING, TESTING AND FABRICATION INSPECTION” of the GENERAL REQUIREMENTS. The CONTRACTOR shall furnish all facilities for the inspection of materials and workmanship in the shop and the INSPECTOR shall be allowed free access to the necessary parts of the work. The INSPECTOR shall have the authority to reject any materials or work not meeting the requirements of these Specifications. Approval of the work by the INSPECTOR, however, shall not relieve the CONTRACTOR of the responsibility of providing a fabricated structure that is in accordance with the drawings and specifications.

3. High-strength bolts shall be installed and verified using the procedure(s) indicated in the Contract Documents, as set forth in the current “Specification for Structural Joints Using ASTM A325 or A490 Bolts”.

4. Structural Steel Material Testing:

a. Except where specified otherwise, the City’s Standards Laboratory; selected testing laboratory will pick up specimens and make required tests in accordance with the GENERAL REQUIREMENTS and this Section. This is in addition to any and all requirements performed by the Mill/Fabricator to prepare the material’s mill certification.

b. Test specimens shall be furnished by the steel fabricator at no additional cost, and shall be selected by the INSPECTOR from the heat of material being supplied.

c. Each specimen shall be machined by the CONTRACTOR to dimensions required by

ASTM A370.

d. Cost of procuring, making, preparing and machining test specimens shall be considered to be included in CONTRACTOR'S bid.

e. If structural steel can be identified by heat or melt number, and if accompanied by mill analysis and test reports, not less than one tension and one bent test will be made for each ten tons or fractional part thereof.

f. If structural steel cannot be identified, it shall not be permitted on the project. Structural steel shall not be erected without any test results and their acceptance by the ENGINEER.

g. If steel pipe can be identified by heat or melt numbers, or manufacturer's name, not less than one tension test and one bent test will be made for each ten tons or fractional part thereof.

h. If a test specimen fails to comply with the specified requirements, not less than two (2) tension and two (2) bent test will be made for each five tons or fractional part thereof of that heat of material.

i. Additional tests may be required when deemed necessary by the ENGINEER.**]**

5. Fabrication of high strength steel shall conform to LADBS requirements as stipulated in Information Bulletin P/BC 2008-032 or latest revision, except field welding is permitted when specifically shown on the Contract Drawings.

6. Welding Inspection:

   a. Except where specified otherwise, the City shall provide Deputy Inspector's visual inspection of welded work. However, where third-party inspection is required, the CONTRACTOR shall perform welding and obtain welding inspection by a qualified inspector from a testing laboratory approved by the INSPECTOR and the Los Angeles City Department of Building and Safety.

   b. Inspect every layer of weld for quality, penetration, and conformity with the design requirements.

   c. When the CONTRACTOR retains the services of a qualified welding inspector, that inspector shall submit a signed report to the ENGINEER and the INSPECTOR, verifying that:
      i. The welding is adequate and was performed in conformity with design requirements.
      ii. Adequate testing methods have been used to determine the quality of the welding.

   d. Welded connections shall be inspected for conformance with the requirements of AWS D1.1 and these specifications.

   e. CONTRACTOR shall provide all equipment for tests specified at no cost to the City.

   f. Welded headed anchors / shear connectors shall be visually inspected by qualified personnel as per AWS D1.1. See LADBS Information Bulletin P/BC 2008-046, "Composite Steel Concrete Construction" for additional requirements, including bend test of shear connectors.

7. Non-destructive testing of shop welds shall include, but not be limited to, the following:

a. Thirty percent of full penetration welds shall be ultrasonically or radiographically tested by a qualified NDT technician per AWS D1.1 and as noted herein. However, when approved by the ENGINEER, the non-destructive testing rate for an individual welder or welding operator may be reduced to 10 percent, provided the reject rate is demonstrated to be 5 percent or less of the welds tested for the welds or welding operator. Perform all tests in the presence of the INSPECTOR.
    i. Exception: For elements/connections that are part of the seismic load resisting system, the CONTRACTOR shall conform to more stringent requirements and increased percentage of testing as noted in the referenced documents including LADBS, “Standard Quality Assurance Plan for Steel Moment Frames” and AISC “Seismic Provisions For Steel Buildings” at no additional cost to the City.

b. Ten percent of partial penetration, fillet, plug, and slot welds, shall be tested using magnetic particle method by qualified NDT technicians per AWS D1.1. Magnetic particle testing shall be in accordance with ASTM E709. If more than twenty percent of the tested welds fail the test, additional welds as determined by the ENGINEER, shall be tested. Perform in the presence of the INSPECTOR.
    i. Exception: For elements/connections that are part of the seismic load resisting system, the CONTRACTOR shall conform to more stringent requirements and increased percentage of testing as noted in the referenced documents including LADBS, “Standard Quality Assurance Plan for Steel Moment Frames” and AISC “Seismic Provisions For Steel Buildings” at no additional cost to the City.

c. The CONTRACTOR shall notify the ENGINEER of any non-destructive testing failure result in writing prior to repair. Repair method to be approved by the ENGINEER prior to undertaking the repair.

d. The costs of all tests, with the exception of the ultrasonic testing conducted by the City, specified herein shall be borne by the CONTRACTOR.

8. Welds that are required by the INSPECTOR to be corrected or redone shall be retested as directed, at the CONTRACTOR’s expense, and to the satisfaction of the ENGINEER and the INSPECTOR.

9. Fabrication of structural steel for bridge structures shall conform to the appropriate subsections of Section 55-3 of the CSS.

D. Field Inspection, Installation, and Tests

1. Quality Control is the responsibility of the CONTRACTOR for its forces and those of its Subcontractors. The ENGINEER and the INSPECTOR reserve the right to inspect the work at all times. The CONTRACTOR shall provide temporary ladders, steps, scaffolding, planking, etc., necessary for safe access to the work to be inspected.

2. The Contractor shall arrange and pay for such additional tests and inspections of field work as are required by the Building Code and governing authorities and will prepare test reports for the ENGINEER’s review and acceptance.

3. The testing agency will conduct and interpret the tests, and will state in each report whether the inspected work complies with requirements, specifically stating all deviations that exist.

4. Field inspection may include, but not be limited to, the following:

a. Inspection of erection steel work for conformance with this specification and the drawings.

b. Inspection of high strength bolted connections in accordance with “Specification for Structural Joints Using ASTM A325 or A490 Bolts”, including pre-installation verification (Section 7), installation (Section 8), and Inspection (Section 9).

c. Verification of welding procedures specification, welding procedures, and qualifications of welding operators, welders and tackers in accordance with AWS D1.1.

d. Visual inspection of field welds and field welded headed anchors\shear connectors in accordance with AWS D1.1 and LADBS, including the bend test.

5. Non-destructive testing of field welds shall include, but not be limited to, the following:

a. Thirty percent of full penetration welds shall be fully ultrasonically or radiographically tested by qualified NDT personnel as per AWS D1.1. If more than ten percent of the tested welds fail the test, additional welds as determined by the ENGINEER, shall be tested.
   i. Exception: For elements/connections that are part of the seismic load resisting system, the CONTRACTOR shall conform to more stringent requirements and increased percentage of testing as noted in the referenced documents including LADBS, “Standard Quality Assurance Plan for Steel Moment Frames” and AISC “Seismic Provisions For Steel Buildings” at no additional cost to the City.

b. Ten percent of partial penetration, fillet, plug, and slot welds, shall be tested using magnetic particle method by qualified NDT personnel as per AWS D1.1. Magnetic particle testing shall be in accordance with ASTM E709. If more than twenty percent of the tested welds fail the test, additional welds as determined by the ENGINEER, shall be tested.
   i. Exception: For elements/connections that are part of the seismic load resisting system, the CONTRACTOR shall conform to more stringent requirements and increased percentage of testing as noted in the referenced documents including LADBS, “Standard Quality Assurance Plan for Steel Moment Frames” and AISC “Seismic Provisions For Steel Buildings” at no additional cost to the City.

c. The CONTRACTOR shall notify the ENGINEER of any non-destructive testing failure result in writing prior to repair. Repair method to be approved by the ENGINEER prior to undertaking the repair.

6. The testing agency will conduct and interpret the tests, and will state in each report whether the inspected work complies with requirements, specifically stating all deviations there from.

7. The costs of all tests **[**, with the exception of the ultrasonic testing conducted by the City,**]** specified herein shall be borne by the CONTRACTOR.

8. Welds that are required by the INSPECTOR to be corrected or redone shall be retested as directed, at the CONTRACTOR’s expense, and to the satisfaction of the ENGINEER and the INSPECTOR.

E. Structural Observation: The **[**Engineer / Architect**]** of Record or its designee shall perform the structural observation as stipulated in the Contract Documents and as required by LADBS. Upon completion of the observation of each designated stage of construction or element, the observer shall prepare, sign, and seal the necessary report and submit it to the building official. A copy shall also be provided to the ENGINEER and INSPECTOR. The CONTRACTOR shall submit a written request to the ENGINEER indicating the need for structural observation at least 48 hours before the observation is needed.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. General: New tested and fabricated stock complying with applicable grades and standards hereinafter referenced. Unless noted otherwise, the material specification noted hereon shall apply. No dual rated steel shall be allowed in this project.

B. Plates and Bars: Per ASTM A36 and ASTM A572 Grade 50

C. Channels and Angles: Per ASTM A36

D. W-Shapes: Per ASTM A992

E. Hollow Structural Sections (HSS): Per ASTM A500, Grade B, structural tubing.

F. Steel Pipe: Per ASTM A53, Type E or S, Grade B

1. Weight Class: As indicated
2. Finish: Black, except where indicated to be galvanized.

G. Stainless steel shapes and plates: Per ASTM A167, Type 316L

H. E70 - T4 weld metal shall not be used for any welds. All welds indicated in members and connections of the seismic load resisting system shall be made with filler metal with a Charpy V-Notch toughness of 20 ft-pounds minimum at zero degrees Fahrenheit. See AISC Seismic Provisions and Contract Drawings for additional requirements.

I. Structural steel shall be cleaned and coated with a shop paint primer; except, that primer shall be omitted for members to be covered with galvanized coating or fire proofed with no further coating.

J. All structural members shall be furnished full length without splices unless otherwise noted or approved by the ENGINEER.

K. Primer: Approved primer indicated in Section [09800], “Protective Coating”

L. Paint: Approved paint indicated in Section [09900], “Painting”

M. Teflon Base Plates: Reinforced Teflon, pre-bonded to steel plates and combined with neoprene bearing pad and having a static friction coefficient of maximum 6 percent, as manufactured by Fluorocarbon Company of Anaheim or equal.

N. Non-Shrink Grout: Approved non-shrink grout in accordance with Section [03315], “Grout”. Minimum compressive strength shall be 3,000 psi in 7 days.

O. Open-Web Steel Joists: In accordance with Section 05210

P. Galvanizing: Per A123 or A153 and in accordance with Section [05500], “Miscellaneous Metal Works”.

Q. Galvanizing Repair Material: Per Section [05500], “Miscellaneous Metal Works”

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-strength Bolts, Nuts, and Washers: Per ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon steel nuts; and ASTM F436 hardened carbon steel washer.

1. Finish: Plain, except where indicated otherwise
2. Direct-Tension Indicators: Per ASTM F959, Type 325, compressible-washer-type.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assembly: ASTM F1852, Type1, heavy hex head steel structural bolts with splined ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers. Only manufacturer applied lubricant is permitted..

1. Location: As substitutes where A325, Type 1, plain bolts are specified, when approved by the ENGINEER.
2. Finish: Plain, unless noted otherwise.
3. Quality Assurance: Meet pre-installation verification, installation, and inspection requirements of RCSC specifications.

C. High-Strength Bolts, Nuts, and Washers: Per ASTM A490, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers, plain. Locations as indicated on Drawings.

1. Direct-Tension Indicators: Per ASTM F959, Type 490, compressible-washer-type, plain

D. Tension-Control, High-Strength Bolt-Nut-Washer Assembly: ASTM F2280, Type 1, heavy hex head steel structural bolts with splined ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers. Only manufacturer applied lubricant is permitted.

1. Location: As substitutes where A490, Type 1, plain bolts are specified, when approved by the ENGINEER.
2. Finish: Plain
3. Quality Assurance: Meet pre-installation verification, installation, and inspection requirements of RCSC specifications.

E. Machine bolts with nuts and washers: Per ASTM A307; hot dip galvanize per A153 not less than 1.25 oz per square foot; use self locking nuts or lock washers with plain nuts. Locations as indicated on Drawings.

F. Bolts and washers to connect dissimilar metals: Per ASTM A193 and A194, Type 316 stainless steel

G. Shear Connectors: ASTM A108, Grade 1015 through 1020, headed-stud type, threaded type, cold-finished carbon steel; ASTM A496, deformed bar anchor; conform to AWS D1.1, Type B.

1. Location of each type: As indicated on the Contract Drawings

H. Unheaded Anchor Rods: ASTM F1554, Grade 36.

1. See Specification 03250 for related information.
2. Configuration: Hooked, unless noted otherwise.
3. Nuts: ASTM A563 hex carbon steel
4. Plate washers: ASTM A36 carbon steel
5. Washers: ASTM F436 hardened carbon steel
6. Finish: Plain

I. Headed Anchor Rods: ASTM F1554, Grade 36, straight, unless noted otherwise.

1. Nuts: ASTM A563 hex carbon steel.
2. Plate Washers: ASTM A36 carbon steel
3. Washers: ASTM F436 hardened carbon steel
4. Finish: Plain.

J. Threaded Rods: ASTM A36

1. Nuts: ASTM A563 hex carbon steel.
2. Washers: ASTM F436 hardened carbon steel
3. Finish: Plain.

K. Adhesive concrete anchors and/or anchor rods shall use stainless steel anchor rods/assemblies conforming to the requirements of Section **[**03250**]** and associated current City of Los Angeles Research Report.

L. Eye Bolts and Nuts: ASTM A108, Grade 1030, cold-finished carbon steel

M. Sleeve Nuts: ASTM A108, Grade 1018, cold-finished carbon steel.

PART 3 -- EXECUTION

3.1 GENERAL

A. Surface Conditions: The CONTRACTOR shall examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected.

B. Measurement: The CONTRACTOR shall verify all dimensions, grades, elevations, job conditions, and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work. The CONTRACTOR shall review the Drawings and any discrepancies shall be reported to the ENGINEER for clarification prior to starting fabrication and erection.

C. Pre-Fabrication And Pre-Erection Conference: Coordinate and arrange for pre-fabrication and pre-erection conferences with the fabricator or manufacturer, INSPECTOR and ENGINEER as required by the Code Requirements and LADBS. Do not proceed with any work prior to the conferences taking place.

3.2 FABRICATION

A. General:

1. Workmanship: In accordance with AISC Specification, Code of Standard Practice, applicable AISC references, with modifications and additional requirements specified here in, as indicated on the Drawings, and as indicated on the shop drawings.

2. Safety Precautions: Conform to latest edition of ANSI/AWS Z49.1, “Safety in Welding and Cutting and Allied Processes”. The Contractor shall determine the applicability of any regulatory limitation prior to use.

B. Shop Fabrication and Assembly of Structural Steel:

1. Fabricate items of structural steel in accordance with AISC specifications, and as indicated on the approved Shop Drawings. Fabrication and assembly shall be done in the shop to the greatest extent possible.

2. Properly mark and match-mark materials for field assembly and for identification as to location for which intended.

3. Fabricate for delivery sequence which will expedite erection and minimize field handling of

materials.

4. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations.

5. Provide finish surfaces of members exposed in the final structure free from markings, burrs, and other defects.

6. Joints and intersections to be accurately made, tightly fitted, true to plane and accurately fastened.

7. Camber structural steel where indicated.

8. Care shall be taken so over grinding does not occur. The maximum reduction of the base metal thickness, as delivered, shall not be more than 1/32-in or 5% of the element/member thickness, whichever is less. Welds shall not be over ground so as to reduce their effective throat size below what is called for on the drawings.

C. Architecturally Exposed Structural Steel (AESS)

1. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for steel identified as AESS.

2. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.

3. Remove blemishes by filling or grinding and sanding or by welding and grinding and sanding, before cleaning, treating, and shop priming.

4. Fabrication to be performed at LADBS approved fabrication facility.

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

6. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerance. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.

b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds**]**

D. Thermal Cutting: When permitted, perform thermal cutting by machine to the greatest extent possible.

E. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

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

G. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning".

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors per AWS D1.1 and the manufacturer's written instructions.

I. Bases and Bearing Plates: Shop weld to columns and to members which are attached to concrete.

3.3 CONNECTIONS

1. Method: Bolted or welded as indicated on the Drawings.

2. Provide bolts and washers of types and sized required for completion of shop fabrication or field erection.

3. Unless otherwise indicated on the drawings, minimum beam framing connections shall be in accordance with AISC “Steel Construction Manual”, have a minimum of two ¾-inch diameter high strength bolts, and be able to develop full strength of members joined.

4. Unless otherwise indicated on the drawings, double-angle members shall be connected together in accordance with AISC Specifications, with a ¾-in diameter, high-strength bolt and a filler plate or welded filler plate.

5. Column ends shall be square and milled to have full bearing at splices and at end plates.

6. The CONTRACTOR shall notify the INSPECTOR to make arrangements to inspect high strength bolted connections and welded connections and to perform testing and prepare test reports. This inspection shall be in addition to the inspection specified in subsections 1.5 of this specification.

7. High Strength Bolted Construction:

   a. Install high strength threaded fasteners in accordance with RCSC Specifications.

   b. **[**Use ASTM A325 bolts, with slip critical connections and Type A surface, unless noted otherwise, except for handrails, ladders, and girt connections.**]**

   c. CONTRACTOR shall provide all equipment for testing of bolted connections as required by Code or Contract Documents at no additional cost to the City.

3.4 WELDED CONSTRUCTION:

A. Comply with all AWS Referenced Documents and this Contract for procedures, appearance, and quality of welds and welders, methods used in correcting welding work, and the following:

1. Shop welding to be done by a fabricator licensed by LADBS.
2. All shop and field welders shall be LADBS certified.

3. Repair welds only after a repair is deemed an acceptable remedy by the ENGINEER using methods also approved by the ENGINEER prior to performing the repair. Cost of repairs to be borne by the CONTRACTOR.

4. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

5. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. CONTRACTOR shall furnish shop drawing prepared by a California Licensed Civil or Structural Engineer.

B. Stainless steel welding shall conform to the details and standards of workmanship of this specification and AWS D1.1, except that the prequalified welds for carbon steel are not applicable to stainless steel. Welders and weld procedures for stainless steel shall be specifically qualified per AWS B2.1 for the type of stainless steel to be welded and LADBS. Welders and weld procedures for welding of stainless steel to carbon steel shall be qualified per AWS B2.1 and LADBS.

C. Unless otherwise shown, all butt and bevel welds shall be complete penetration.

3.5 HOLES FOR OTHER WORK

A. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on the Shop Drawings.

B. Provide threaded nuts welded to framing, and other specialty items as shown, to receive other work

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

D. Do not thermally cut holes or enlarge holes by burning.

E. Drill holes in bearing plates.

3.6 SHOP PAINT PRIMER

A. General:

1. Apply shop paint primer to structural steel work in accordance with Section [09800], “Protective Coating”.

2. Shop prime steel surfaces except for the following:

a. Surfaces embedded in concrete or mortar. However, extend priming of partially embedded members to a depth of 2-inches.

b. Surfaces to be welded and high-strength bolted with slip-critical connections. Such areas shall be primed and finish coated after connection is made and inspected. See Figure C-3.1 of RSCS Specification for illustration of bolted connection requirements.

c. Surfaces to receive sprayed-on-fireproofing.

d. Galvanized surfaces.

3. Apply one coat of primer and two coats of paint to surfaces which are inaccessible after assembly or erection. Change color of the second coat to distinguish it from the first.

B. Surface Preparation:

1. After inspection and before shipping, clean steel work to be painted.

2. Remove loose rust, loose mill scale, and spatter, slag, and flux deposits.

3. Clean and prepare the steel in accordance with the following specifications and standards:

a. SSPC – SP2: “Hand Tool Cleaning”
b. SSPC – SP3: “Power Tool Cleaning,” where needed.

C. Priming:

1. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer’s written instruction and at a rate to provide a uniform dry film thickness of not less than 3.0 mils.

2. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

D. Galvanizing:

1. Hot-Dip Galvanizing: Galvanize structural steel members conforming to ASTM A123.

Provide minimum 2.0 oz/sq.ft. of galvanized coating.

2. Fill vent holes and grind smooth after galvanizing.

3. Exposed structural and miscellaneous steel not otherwise protected shall be galvanized.

3.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

C. Load structural members in such a manner that they may be transported and unloaded without being excessively stressed, deformed, or otherwise damaged. This includes protection of coating from chipping and scratches.

D. Protect structural steel members and packaged materials from corrosion and deterioration. Material shall be stored in a dry area and shall not be placed in direct contact with the ground. Do not place materials on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

3.8 ERECTION

A. The CONTRACTOR shall comply with the AISC Specifications and Code of Standard Practice, and with specified requirements.

B. High-strength bolts shall be installed per the Specification for Structural Joints using ASTM A325 or ASTM A490 and this section.

C. Anchor Bolts:

1. Provide as indicated on the Contract Drawings; anchor bolts and other connectors required for securing structural steel to foundation and other in-place work

2. Provide templates and other devices necessary for presetting bolts and other anchors to accurate locations in concrete or masonry construction.

3. Contractor shall arrange and pay for all testing for anchor bolts or dowels as required by the Codes and Standards.

4. For dynamically loaded structures or where vibrations are being induced into the structure/anchor bolts, provide structurally conforming lock nuts, structural nuts with lock washers, or a chemical thread seizing compound, such as "Loctite" or equal, as approved b the ENGINEER.

D. Splices:

1. Splice members only where indicated, and with the approval of the ENGINEER.

2. For splices not indicated, submit structural calculations prepared and signed by a California registered Civil or Structural Engineer.

E. Surveys:

1. Establish permanent benchmarks necessary for accurate erection of structural steel.

2. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds.

F. Temporary Shoring:

1. Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads.

2. Provide temporary guy lines to achieve proper alignments of the structure as erection proceeds.

3. Remove temporary connections and members when permanent members are in place and the final connections have been made.

G. Not Used

3.9 SETTING BASES AND BEARING PLATES

A. Prior to the placement of non-shrink grout beneath base and bearing plates, the bottom surface of the plates shall be cleaned of all bond-reducing materials, and concrete and masonry bearing surfaces shall also be cleaned of all bond-reducing materials and roughened to improve bonding.

B. Set loose and attached base plates and bearing plates for structural members on wedges, leveling nuts, or other adjustable devices.

C. Tighten the anchor bolts after the supported members have been positioned and plumbed.

D. Do not remove wedges or shims but, if they are protruding, cut off flush with the edge of the base or bearing plates to assure that no voids remain.

E. Grouting of base plates shall be done with non-shrink grout, of flowable consistency, as specified in Section 03315 "Grout". Grouting shall be completed prior to placing loads on the structure.

F. Finish exposed surfaces, protect installed materials, and allow grout to cure in strict compliance with the manufacturers' recommendations and acceptance requirements by the ENGINEER.

3.10 FIELD ASSEMBLY

A. Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members to form a part of a complete frame or structure before permanently fastening. Clean the bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

B. Level and plumb individual members of the structure within specified AISC tolerances. CONTRACTOR shall provide and install all temporary bracing necessary to carry construction loads until the structure has been completed.

C. Establish required leveling and plumbing measurements at the main operating temperature of the structure, making allowances for the difference between temperature at time of erection and the mean temperature at which the structure will be when completed and in service.

D. Comply with AISC Specifications and Code of Standard Practice for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to welds.

E. No driven nail or fastener, coreholes or other attachments shall be made or allowed on any steel members without the written approval by the ENGINEER.

3.11 TESTING AND INSPECTION

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A. Quality Control is the responsibility of the CONTRACTOR for its forces and those of its Subcontractors. Schedule and coordinate with the INSPECTOR all necessary tests, special

inspection, and overall general quality assurance inspection both in the shop and in the field.

B. Inspection by Others: Schedule and coordinate all necessary tests, inspections, and quality control services with the authorities having jurisdiction, including the Department of Building and Safety and notify the INSPECTOR that such inspections are taking place.

3.12 MISFITS AT BOLTED CONNECTIONS

A. Where misfits in erection bolting are encountered, the CONTRACTOR shall immediately notify the ENGINEER. The CONTRACTOR shall submit a method to remedy the misfit for review by the ENGINEER. The ENGINEER will determine whether the remedy is acceptable or if the members must be refabricated. Methods of remedy for consideration by the ENGINEER may include, but are not limited to, the following:

1. Ream holes that must be enlarged to admit bolts and use oversized bolts.

2. Plug-weld misaligned holes and redrill holes to admit standard size bolts.

3. Drill additional holes in the connection, conforming with AISC Standards for bolt spacing and end and edge distances, and add additional bolts.

4. Reject the improperly fabricated member and fabricate a new member to ensure proper fit.

B. Mis-sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins.

3.13 MISFITS AT ANCHOR BOLTS

A. Where misalignment between anchor bolts and bolt holes in steel members are encountered, the ENGINEER shall be immediately notified. The CONTRACTOR shall submit a method to remedy the misalignment for review by the ENGINEER.

3.14 GAS CUTTING

A. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing, except on secondary members which are not under stress and will be concealed in the finished structure and when approved by the ENGINEER. Finish gas-cut sections equal to a sheared appearance.

3.15 TOUCHUP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint primer. Apply touchup paint primer by brush or spray which is the same thickness and material as that used for the shop paint. Galvanized surfaces which have been field welded or damaged shall be repaired in accordance with Section [05500] "Miscellaneous Metalwork."

3.16 FIELD PAINTING

A. General:

1. Prepare surfaces in a manner appropriate to the condition, and as approved by the ENGINEER.

2. Clean spots and surfaces where primer coats have been removed, damaged, or burned off, and clean field bolts and other field connections not concealed in the finished work.

3. Remove dirt, oil, and grease.

4. Apply a spot coat of the approved primer.

5. Do not apply paint to wet, damp, oily, or improperly prepared surfaces.

B. Notify the ENGINEER when the work of this Section is ready to receive field painting. Lapse time between surface areas if necessary at no additional cost to the City.

C. Schedule for inspection and secure approval from the ENGINEER prior to field painting.

D. Using spray or brush, as recommended by the manufacturer of the approved paint material, fill all joints and corners and cover the surfaces with a smooth unbroken film of at least 1.5 dry mils thickness.

E. Apply two coats to all surfaces of steel which will be in accessible for painting, after fabrication and erection.

* * * *

SECTION 05500
MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Any miscellaneous metal required as part of the permanent work shall comply with the applicable requirements of this Section.

B. The CONTRACTOR shall furnish, fabricate, and install miscellaneous metalwork and appurtenances, complete, in accordance with the requirements of the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section **09800** Protective Coating.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the reference specifications of the GENERAL REQUIREMENTS and the specifications and standards listed below.

B. Federal Specifications:

QQ-F-461 C (1)	Floor Plate, Steel, Rolled.
MIL-6-18015	(Ships) Aluminum Planks. (6063-T6)

C. Commercial Standards:

Aluminum Assn. AA-M32	C22A41.
AASHTO HS-20	**[Truck Loading].**
AISC	**[Specify applicable sections]**
AISI	**[Specify applicable sections]**
ASTM A36	Specification for Structural Steel.
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A 125	Specification for Steel Springs, Helical, Heat Treated.
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.
ASTM A 563	Specification for Carbon and Alloy Steel Nuts.
ASTM A 575	Specifications for Steel Bars, Carbon, Merchant Quality, M-Grades.

ASTM B 98	Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
ASTM B 438	Specification for Sintered Bronze Bearings (Oil-Impregnated).
ANSI/AWS D1.1	Structural Welding Code - Steel.
NFPA 101	Life Safety Code.
NAAMM	Metal Stairs Manual.

1.4 CONTRACTOR SUBMITTALS

A. Shop Drawings: Shop drawings of all miscellaneous metalwork shall be submitted to the ENGINEER for review in accordance with **SUBMITTALS** of the GENERAL REQUIREMENTS.

B. Anchors: Wherever power-driven pins will be utilized for anchorage or support, complete information describing pin capacity, connections, and proposed use locations shall be furnished to the ENGINEER.

1.5 QUALITY ASSURANCE (NOT USED)

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Standard: All structural steel shapes, plates, bars, and their products shall conform to the requirements of ASTM A 36.

B. Corrosion Protection: Unless otherwise shown, miscellaneous metalwork of fabricated steel, which will be used in a corrosive environment and/or will be submerged in water/wastewater shall be coated in accordance with Section 09800, "Protective Coating" and shall not be galvanized prior to coating. All other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication as specified herein.

C. Stainless Steel: Unless otherwise shown, stainless steel metalwork and bolts shall be of Type 316 stainless steel and shall not be galvanized. Where anaerobic conditions are anticipated, Type 304 stainless steel shall be used.

2.2 ALUMINUM RAILINGS

A. General: All aluminum handrails and railings shall be component systems complete with all anchors, attachments, balusters, brackets, caps, fasteners, gates (swing with self-latching hardware or removable), posts, sleeves, trim, and any other related items required or necessary for a complete installation. All gates and removable rail sections shall be complete with all hardware such as self-closing hinges, self-latching latches, hasps, etc. Railings shall conform to the Building Code and OSHA General Industry Occupational Safety and Health Standards (29CFR1910).

B. Materials: All materials for miscellaneous metalwork shall conform to the following requirements:

1. Aluminum: Aluminum shall be U.S. Alloy 6063 T-5 or T-6. Aluminum pipe rail shall not be less than 1-1/2-inch diameter Schedule 40 pipe.

2. Electrolysis Protection: Electrolysis protective material shall be alkali-resistant asphaltum base paint, Koppers "Bitumastic 50," Texaco "Cement 1401," or equal.

3. Sleeves: Sleeves shall be of galvanized steel or PVC.

4. Grout: Grout for hand rail posts shall consist of an inorganic, non-shrink, non-metallic premised grout with a minimum 28-day compressive strength of 4,000 psi.

5. Fasteners: Fasteners, screws, and bolts shall be concealed and shall be of stainless steel or aluminum.

6. Welding Rods: Aluminum welding rods shall be of a type recommended by the aluminum manufacturer for anodized finished products.

C. Finishes: Pipe railing system including handrails, railings, tube caps, and other miscellaneous parts of rails shall be provided with a clear anodized finish, AA-M32 C22A41.

D. Manufacturers or Equal:

1. **C-V Pipe Rail**, by Crane Veyor Corp..

2. **Reyno-Rail II**, by Reynolds Aluminum Co.;

2.3 STEEL PIPE HANDRAILS

A. Steel pipe handrails, including brackets and related hardware, which may be partially or wholly submerged, or which are located inside a hydraulic structure, shall be entirely of Type **[304] [316]** stainless steel. All other steel pipe handrails shall be standard 1-1/2-inch black steel pipe made up by welding and hot-dip galvanized after fabrication.

2.4 STEEL STAIRS AND ALUMINUM SAFETY TREADS

A. Steel Stairs: Steel stairs shall be fabricated in accordance with standard practice of the National Association of Ornamental Metal Manufacturers, and as shown. Steel stairs shall be hot-dip galvanized after fabrication.

B. Safety Treads: Safety stair treads shall be provided on all stairs, and elsewhere where shown. The safety treads shall be 4 inches wide, shall be of aluminum, and shall be American Abrasive Metals Company, **[Style A]**; American Mason Safety Tread Company; or equal.

2.5 LADDERS

A. Ladders which may be partially or wholly submerged, or which are located inside a hydraulic structure, shall be entirely of Type 316 stainless steel. All other ladders shall be of carbon steel, hot-dip galvanized after fabrication.

2.6 METAL GRATING AND FLOOR HATCHES

A. General: Metal grating and floor hatches shall be of the design, sizes and types shown. Aluminum in contact with other metal or concrete shall be shop-painted in accordance with System 208 of Section 09800, "Protective Coating."

B. Metal Grating: Metal grating shall be of aluminum or stainless steel as shown. No single piece of grating shall weigh more than 80 lb unless otherwise specified or shown. Aluminum shall be 6061T6 Alloy Bearing Bars and 6063T5 Alloy Cross Bars. Stainless steel shall be Type 316. All grating shall be completely banded.

C. Floor Hatches: Floor hatches shall be of steel or aluminum as shown. Hatches shall be double-swing, and shall be furnished with 2 stay bars designed to hold the cover in an open position and provide a railing around the opening, stay bar brackets designed to provide storage for the bars

when the hatch is closed, 4 flush handles, joint gutter, and a moat-type edge drain complete with drain connection. Steel hatches shall be hot-dip galvanized after fabrication.

2.7 PIPE COLUMNS

A. Pipe column steel shall conform to the requirements of ASTM A 53, Grade B.

2.8 METAL DECKING

A. Metal decking shall be of the size and gage shown and shall meet the requirements of the specification for the "Design of Light Gage, Cold-formed Steel Structural Members," of the American Iron and Steel Institute. The steel shall be hot-dip galvanized after fabrication.

2.9 IRON CASTINGS

A. Iron castings shall conform to the requirements of ASTM A 48 unless otherwise shown.

2.10 FALL PREVENTION SYSTEM

A. The fall prevention system shall be the **[Everest Lifeline System Model No. 6006]**, as manufactured by the Research and Trading Corporation, Wilmington, Delaware; **[Saf-T-Climb]**, as manufactured by North Consumer Products, Inc., California; or equal. All necessary components shall be furnished, including the safety belt, to provide a complete and fully operational fall prevention system.

2.11 SEAT ANGLES, SUPPORTS, AND GUIDES

A. Seat angles for grating shall be aluminum or steel as shown and of a size as shown. Guides for slide gates shall be steel, of a size shown, hot-dip galvanized after fabrication.

2.12 BOLTS AND ANCHORS

A. Standard Service Bolts (Not Buried or Submerged): Except where otherwise shown or specified, all bolts, anchor bolts, and nuts shall be steel, galvanized after fabrication as specified herein. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing. Except as otherwise specified herein, steel for bolts, anchor bolts and cap screws shall be in accordance with the requirements of ASTM A 307 Grade A or B, or threaded parts of ASTM A 36.

B. Buried or Submerged Bolts: Unless other corrosion-resistant bolts are shown, all bolts, anchor bolts and washers which are buried, submerged, or below the top of the wall inside any hydraulic structure shall be of Type 316 stainless steel, with bronze nuts, or cap screws (where screwed into stainless steel), of copper-silicon alloy, conforming to ASTM B 98, alloy C 65100, designation H04, or alloy C 65500, designation H04. Wherever stainless steel bolts and nuts are specified, it shall refer to the above material combination, unless specifically excluded. Where anaerobic conditions are anticipated, Type 304 stainless steel shall be used.

C. Bolt Requirements:

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads. All bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.

D. Adhesive Anchors: Unless otherwise shown or specified, all drilled, concrete or masonry anchors shall be adhesive anchors. No material substitutions will be considered unless accompanied with ICBO report verifying strength and material equivalency.

1. Epoxy adhesive anchors are required for drilled anchors where exposed to weather, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails, pumps, mechanical equipment, and reinforcing bars. Epoxy systems shall be **[Sika/FI System with Sikadur Injection Gel Epoxy]** or **[Masterbuilders Concresive Epoxy Cartridge Dispensing System and Concresive Paste LPL]**. Threaded rod shall be stainless steel Type 316.

2. Unless otherwise shown, glass capsule, polyester resin adhesive anchors will be permitted in locations not specified above and shall be **[Hilti HV]** or **[Molly Parabond]**. Threaded rod shall be galvanized steel.

E. Expanding-Type Anchors: Expanding-type anchors if shown or permitted, shall be steel expansion type Phillips Drill Company "Red Head" anchors; McCullock Industries "Kwick-Bolt;" or equal. Lead calking anchors will not be permitted. Size shall be as shown. Expansion type anchors which are to be embedded in grout may be steel. Non-embedded buried or submerged anchors shall be stainless steel.

2.13 POWER-DRIVEN PINS

A. Materials: Power-driven pins for installation in concrete or steel shall be heat-treated steel alloy. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they are to be exposed, they shall be protected in an acceptable manner. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support. Pins that are connected to steel shall have longitudinal serrations around the circumference of the shank.

PART 3 -- EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

A. Fabrication and Erection: Except as otherwise shown, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

B. Aluminum Railings: Aluminum railing fabrication and installation shall be performed by craftsmen experienced in the fabrication of architectural metalwork. Exposed surfaces shall be free from defects or other surface blemishes. Dimensions and conditions shall be verified in the field. All joints, junctions, miters and butting sections shall be precision fitted with no gaps occurring between sections, and with all surfaces flush and aligned. Electrolysis protection of materials shall be provided.

C. Steel Railings: Field welding of steel pipe handrail joints will be permitted only if approved by the ENGINEER, and then only in accordance with its instructions.

D. Floor Hatches: Unless otherwise shown, the CONTRACTOR shall furnish and install a 1/2-inch drain line to the nearest floor drain for all floor hatches.

E. Power-Driven Pins: Power-driven pins shall be installed by a craftsman who is certified by the manufacturer as being qualified to install the manufacturer's pins. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration. Driven pins shall conform to the following requirements where "D" = Pin's shank diameter:

Material Penetrated by Pin	Material's Minimum Thickness	Pin's Shank Penetration in Supporting Material	Minimum Space From Pin's CL to Edge of Penetrated Material	Minimum Pin Spacing
Concrete	16D	6D minimum	14D	20D
Steel	1/4-inch	Steel thickness	4D	7D

3.2 WELDING

A. Method: All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

B. Quality: In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS Code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.3 GALVANIZING

A. All structural steel plates shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123. Any galvanized part that becomes warped during the galvanizing operation shall be straightened. Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A 153. Field repairs to galvanizing shall be made using **"Galvinox," "Galvo-Weld,"** or equal.

3.4 DRILLED ANCHORS

A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, cleaned and dry. Drilled anchors shall not be installed until the concrete has reached the specified 28-day compressive strength. Adhesive anchors shall not be loaded until the adhesive has reached its specified strength in accordance with the manufacturer's instructions.

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SECTION 05520
HANDRAILS AND RAILINGS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated on the Drawings and specified herein.

B. This section covers the work necessary to furnish and install handrails and railings, complete.

1.2. ELATED WORK SPECIFIED ELSEWHERE

A. Section 03300 Cast-in-Place Concrete

B. Section 05500 Miscellaneous Metalwork

C. Section 09800 Protective Coating

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards.

1. Government Standards:

California OSHACalifornia Occupational Safety and Health Standards.

2. Trade Standards:

Aluminum Association (AA) publications, as referenced herein.

3. Manufacturer's Standards: In addition to the standards listed above, the railings and their installation shall be in accordance with the manufacturer's published recommendations and specifications.

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the GENERAL REQUIREMENTS.

B. The following submittals and specific information shall be provided:

1. Shop Drawings

2. Calculations: Engineering calculations shall be submitted for review. Engineering calculations shall include (but not be limited to) railings, handrail brackets, brackets, support flanges, and fasteners or anchors.

1.5 QUALITY ASSURANCE (Not Used)

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken packages, containers, or bundles bearing the label of the manufacturer.

B. Storage: All materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 -- PRODUCTS

2.1 ALUMINUM HANDRAIL SYSTEMS

A. General: Aluminum handrail systems or components shall be fabricated as shown or shall be an ENGINEER-accepted prefabricated/pre-engineered system or component by one fabricator/manufacturer that meet the submittal requirements as stated in SUBMITTALS of the General Requirements. Manufacturers who may meet these specified requirements are: Alumaguard, a division of Bettinger West, Inc., Denver, CO; or Thompson Fabricating Co., Birmingham, AL; or approved equal. These systems shall meet the allowable load and deflection criteria.

B. Pipe:

1. All rails, posts, and formed elbows shall be fabricated from extruded Alloy 6105-T5 with a minimum tensile strength of 38,000 psi and a minimum yield strength of 35,000 psi, and with special close tolerance for tight fit and excellent appearance. All other aluminum parts shall be fabricated from 6063-T6 or 6061-T6 extruded aluminum of adequate strength for all loads.

2. Round tube and round picket railings shall be sleeve or side mounted unless otherwise shown. Posts shall be not less than 1-1/2-inch diameter, Schedule 40 pipe or 1-1/2-inch x 2-inches oval section. The posts shall be evenly spaced at not less than 4-feet nor more than 6-feet on centers. Field conditions may require some adjustment of spacing. Pickets shall be not less than 5/8-inch OD pickets, spaced at 4-1/2-inches on center; or 3/4-inch OD pickets. Top rails and railings shall be not less than 1-1/2-inch OD pipe or 2-inch oval section. Rails may be type with bottom enclosures. Bottom rails shall be not less than 1-1/2-inch OD pipe or 1-7/8-inch diameter extrusion with bottom enclosures. The top railings shall be as long as possible and the post shall not project through the top rails. Toeboard of picket rails shall be a specially extruded, snap-in bottom rail enclosure with toeboard or special extruded centered toeboard that is screw applied to bottom of the bottom rail.

C. Fittings:

1. All fittings shall be as shown or shall be one of the following types: A one-piece aluminum extrusion machined to final shape and attached to the handrail post with either concealed welds or a stainless steel fastener. A one-piece connector of aluminum or stainless steel, either welded or attached to the handrail post with stainless steel fasteners and designed to be completely covered when the handrail is connected. All fitting surfaces designed to be exposed to view after installation is complete will match the handrail metal alloy, surface, shape, and anodized finish and shall be the continuous diameter type for smooth appearance and to permit continuous sliding of the hands.

2. The handrail post bolted baseplate connector shall be fabricated as shown on the Drawings or equivalent molded or extruded meeting all of the appearance and strength requirements. The baseplate shown shall conform to ASTM A 167, Type 304 stainless steel with a minimum yield strength of 30,000 psi. The insert shown shall be fabricated from stainless steel pipe with a minimum wall thickness of 0.145-inch and with a minimum yield strength of 50,000 psi. The insert dimensions shall meet the required tolerances shown on the Drawings. Furnish test data

to show that the yield strength of the material in the as-delivered pipe equals or exceeds 50,000 psi. Inserts using stainless steel with minimum yield strengths less than 50,000 psi shall have thicker walls to develop equal strength.

3. The handrail wall brackets, aluminum, round top, similar to R & B Wagner No. 1767; Julius Blum No. 384A; or equal; clear anodized and meeting all the dimensional wall/railing clearance requirements of national, state, and local standards, regulations, and codes, including OSHA.

D. Additional Specific Fabrications:

1. The handrail gate shall meet all the safety requirements of the national, state, and local standards, regulations, and code requirements that specifically apply to this project, including OSHA. The gate shall be fabricated using 6063-T6 extruded aluminum, and as otherwise shown on the Drawings. Gate hardware shall meet all specified requirements. Manufacturers who may provide hardware meeting these Specifications are: Craneveyor Corp., South El Monte, CA; Julius Blum & Co., Inc. Carlstadt, NJ; Thompson Fabricating Co., Birmingham, AL; or approved equal. Provide test reports to show that all gate hardware meets minimum safety strength requirements for handrails and guard rails.

2. The handrail picket panels and clamps shall be fabricated using solid bar 6063, 6105, or 6061 extruded aluminum as shown on the Drawings with finishes specified. All fasteners shall be stainless steel.

3. Toeboards and accessories shall be fabricated as shown on the Drawings, or shall be molded or extruded by a handrail manufacturer providing equivalent appearance, strength, and safety properties to that shown, using 6063 or 6061 aluminum with finishes as specified, meeting all applicable state, federal, and Los Angeles Building Code requirements. All fasteners shall be stainless steel. Provide expansion and contraction connections between each post as shown or equivalent.

E. Embedded Items: All metal anchorages to be embedded in concrete shall be furnished and installed under this section and shall be as shown on the Drawings or as specified herein.

F. Finishes:

1. All exposed aluminum shall be clear anodized in accordance with the Aluminum Association AA-M32-C22-A41. All exposed prefabricated handrail and toeboard handrail, picket panel, and toeboard components, except stainless steel fasteners, shall be anodized after fabrication.

2. All complete rails, modules, and components shall be cushion wrapped to prevent them from being scratched and dented during shipment, storage, and installation. Wrapping shall be left intact, insofar as possible, until the railing is completely installed.

2.2 GALVANIZED STEEL HANDRAILS

A. General: Galvanized steel handrails shall be fabricated by one fabricator.

B. Steel railings materials shall be in conformance with the SSPWC section 206-5.1.

C. Piping: 2-inch NPS with a 2.375-inch outside diameter and a 0.154-inch wall thickness minimum for all rails and posts.

D. Fittings:

1. All handrail fitting components; flanges, wall brackets, anchor plates, and similar accessories shall be hot-dip galvanized after fabrication. All anchor bolts and fasteners shall be stainless steel.

2. The handrail post bolted baseplate connector shall be fabricated from carbon steel meeting the minimum requirements herein specified and as shown on the Drawings. The insert shall be fabricated from pipe with a minimum wall thickness of 0.20-inch or from solid rod. Hot-dip galvanize assembly after fabrication, and provide surface preparation on insert for proper fit into post.

3. The handrail wall brackets shall be malleable iron, round top, similar to R & B Wagner No. 1765; Julius Blum No. 1382; or equal; galvanized, meeting all the dimensional wall/railing clearance requirements of national, state, and local standards, regulations, and codes, including OSHA.

E. Additional Specific Fabrications:

1. The handrail gate shall meet all the safety requirements of the national, state, and local standards, regulations, and code requirements that specifically apply to this project, including OSHA. The gate shall be fabricated using steel as specified hereinbefore for piping and as otherwise shown on the Drawings. Hot-dip galvanize after fabrication. Gate hardware shall be manufactured of Type 304 stainless steel. The hardware shall be similar in function and operation to Craneveyor Corp., South El Monte, CA, gate hinges with spring No. C4370b, gate latch No. C4369, and gate stop No. C4368; Julius Blum & Co., Inc., Carlstadt, NJ, Connectorail System, gate hinges with spring No. 782/3 with gate latch and stop No. 784; or approved equal.

2. The handrail picket panels and clamps shall be fabricated using solid bar steel meeting the minimum requirements herein specified and as shown on the Drawings. Hot-dip galvanize after fabrication. All fasteners shall be stainless steel.

3. Toeboards and accessories shall be fabricated as shown on the Drawings, using A 36 steel. Hot-dip galvanize after fabrication. All fasteners shall be stainless steel.

F. Embedded Items: All metal anchorages to be embedded in concrete shall be furnished and installed under Section 05500, "Miscellaneous Metalwork".

G. Galvanizing:

1. General: Zinc used for galvanizing shall be grade Prime Western conforming to ASTM B 6. Except as otherwise specified, materials shall be galvanized by the hot-dip, mechanical or electro-depositing process.

2. Requirements of Coating: The minimum weight of coating and other requirements shall be 2.0 ounces per square foot of surface area. The weight of coating shall be determined in accordance with ASTM A90, modified to determine the coating of each surface separately. All surfaces, when tested separately, shall meet the minimum requirement.

3. Galvanize in accordance with ASTM A 123 and A 386 after fabrication. The workmanship of zinc coating shall be in conformance with the SSPWC Section 210-3.3.

4. Test Coupon: Test coupons for determining the quantity and quality of the galvanizing shall be in conformance with the SSPWC Section 210-3.4.

2.3 ANCHOR BOLTS, FASTENERS, CONCRETE ANCHORS

A. Miscellaneous Fasteners:

1. Type 316 stainless steel elastic locknuts; Type 316 stainless steel flat washers; molded nylon flat washers; round head machine screws ((RHMS); Type 316 stainless steel, all as supplied by McMaster-Carr Supply Company, Los Angeles, CA**;** or equal.

2. Stainless steel bolts and nuts for bolting handrail to metal beams, unless otherwise shown, shall

be ASTM A 193 and A 194, Type 316 with a minimum yield strength for bolts of 95,000 psi.

3. Anchor bolts, Type 316 stainless steel anchor bolt with a minimum yield strength of 30,000 psi, 5/8-inch minimum diameter with hex nuts, or size as shown.

4. Wedge anchors for exterior use and for interior use shall be 304 or 316 stainless steel, 3/4-inch diameter by 5-inch HILTI Kwik-Bolt, stud type, manufactured by HILTI, Inc., Stamford, CT; Wej-It, stainless steel bolts, 3/4-inch by 5-inch, completely assembled, manufactured by Wej-It Corporation, Broomfield, CO; or equal.

5. Wedge anchors have been limited to 5-inch lengths for use in 6-inch slab and wall thicknesses. Where anchors are to be used in thicker section, larger anchor lengths may be used. Load values for tension pullout with special inspection shall be 3,900 pounds minimum. Special inspection is required.

6. Concrete anchors in other sizes and quantity when used shall be based upon approved test reports with special inspection where required. Submit calculations and test data for review prior to use. Satisfy all applicable codes.

PART 3 -- EXECUTION

3.1 FABRICATION OF ALUMINUM HANDRAIL SYSTEMS

A. The work shall be performed according to approved shop drawings by workmen experienced in the fabrication and erection of aluminum railing systems of the type and quality specified. See the Drawings for other requirements.

B. Handrail post to be bolted to metal or concrete shall be furnished longer than needed and field cut to exact dimensions required to satisfy any vertical variations on the actual structure, or in lieu of field cutting provide an approved fitting containing provisions for vertical adjustment. The Detail Drawings require field fit-up. Shims or grout under baseplates shall not be used. Misfits shall be rejected.

C. The aluminum handrail system shall be completely free of all burrs, nicks, and sharp edges when the installation is complete. Welding shall not be permitted.

D. Coat ends of aluminum posts to be set in grout or concrete as specified in Section [09800], "Protective Coating".

E. The railing shall be erected in the field without cutting, drilling, welding, or tapping unless specifically approved by the ENGINEER.

F. No exposed welds, rivets, or screws shall be permitted unless specifically detailed on the plans.

G. Field welding of aluminum connections shall not be permitted. Welded connections shall be permitted only where indicated on the Contract drawing and on the approved shop drawings.

H. Welding shall conform to the SSPWC Section 304-2.1.2.

I. Railing panels shall be in conformance with SSPWC Section 304-2.1.2

J. For structures on curves, either horizontal or vertical, the railing shall conform to the SSPWC Section 304-2.1.2.

K. Completed aluminum railing units shall be anodized after fabrication and in conformance with the SSPWC Section 304-2.1.2.

3.2 FABRICATION OF GALVANIZED STEEL HANDRAIL SYSTEMS

A. Handrail post to be bolted to metal or concrete shall be furnished longer than needed and field cut to exact dimensions required to satisfy any vertical variations on the actual structure. The Detail Drawings require field fit-up. Shims or grout under baseplates shall not be used.

B. Cut pipe square within 2 degrees and to lengths within 1/8-inch.

C. Remove burrs from cut edges.

D. Form elbow bends and wall returns to uniform radius, free from buckles and twists, with finished surfaces smooth.

E. Close exposed ends of steel pipe by welding 3/16-inch thick steel plate in place or use prefabricated fittings.

F. Welding:

1. Miter and cope intersections of posts and rails within 2 degrees, fit to within 0.02-inch (0.5 mm) and weld all around.

2. Thoroughly fuse without undercutting or overlap.

3. Remove splatter, grind exposed welds to blend, and contour surfaces to match those adjacent.

G. Provide explosion prevention holes at closed ends of pipes.

H. Form and assemble joints which will be exposed to the weather so as to exclude water.

I. Repair of Defective Work: Remove defective work and replace with material that meets Specification requirements.

J. Repair of Damaged Zinc Coating: Zinc coating which has been field or shop cut, burned by welding, abraded, or otherwise damaged to such extent as to expose the base metal, shall be repaired and recoated by one of the following methods:

1. Hot-Dip Process: The damaged areas shall be thoroughly stripped and cleaned and a coating of zinc shall be applied by the hot-dip process.

2. Metalizing Process: The damaged area shall be thoroughly cleaned by blasting with sharp sand or steel grit. The blasted area shall lap the undamaged zinc coating at least 1/2-inch. Zinc wire containing not less than 99.98 percent zinc shall be used in the metalizing operation. A zinc coating shall be applied to the damaged area with a metalizing gun to a thickness of not less than 0.005-inch on the damaged area, and shall taper to zero thickness at the edge of the blasted undamaged section.

3. Zinc Oxide-Zinc Dust Paint: The damaged area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part oxide to four parts zinc dust by weight.

4. Proprietary Materials: Proprietary materials used to repair small areas shall be in conformance with the SSPWC Section 210-3.5.4.

3.3 INSTALLATION

A. Assembly/installation of handrail system shall be performed in strict accordance with manufacturer's written recommendations for installation and the details shown.

B. The railing shall be erected in conformance with the SSPWC Section 304-2.1.3.

C. The railing installation shall be in conformance with the SSPWC Section 304-2.1.3.

D. After erecting the railing, any abrasions or exposed steel shall be repaired as specified.

E. Protection from Entrapped Water: All exterior installations and interior installations subject to high humidity shall have provisions made to drain water from the railing system. When posts are mounted in concrete or when bends or elbows occur at low points, weep holes of 1/4-inch diameter shall be drilled at the lowest possible elevations, one hole per post or rail. Hole shall be drilled in the plane of the rail.

F. Expansion Joints:

1. Provide at intervals of not more than 24-feet on centers and at structural joints as hereinafter specified.

2. Provide slip joint with internal sleeve extending 2-inches beyond each side of joint. Provide slip joint gap of 0.2-inch to allow for expansion.

3. Fasten to one side using either adhesive or two blind rivets, set at 120 degrees and 240 degrees interval from top of pipe.

4. Locate joints within 12-inches of posts. Locate expansion joints in rails to also coincide with expansion joints in the structural walls and floors that support the railings.

G. Setting Posts:

1. Embedded:

a. Clean dust and foreign matter from sleeves or blockouts.

b. Moisten interior of hole and surrounding surface with clean water. Install Category II-B non-metallic grout as specified in Section 03315, "Grout".

c. Brace railing until grout sets.

2. Surface Mounted:

a. The post bolted baseplate connectors shall sit solidly on concrete, stair stringer, or other material as shown on the Drawings. The use of shims, wedges, grout, etc. for handrail post alignment or any other reason will not be permitted.

b. The handrail posts shall be furnished longer than needed and then accurately measured in the field for correct length, cut and secured to the post baseplate connector as shown on the Drawings.

H. Posts and Rails:

1. Set posts plumb and aligned to within 1/8-inch in 12-feet.

2. Set rails horizontal or parallel to rake of steps to within 1/8-inch in 12-feet.

3. Posts and rails shall be all in the same plane. There shall be no projections or irregularities to present a hazard or prevent a user from sliding his hand continuously along the top rail.

I. Handrail Wall Brackets: Support wall rails on brackets, spaced not more than 6-feet on centers. Provide in-wall anchor backplates on solid blocking on stud walls.

J. Toeboard: Toeboards shall be accurately measured in the field for correct length (after handrail post installation), cut and secured to posts as shown on the Drawings. Provide toeboards at all handrails except where concrete curbs are furnished.

K. Handrail Gate: The handrail gate shall be installed to meet safety requirements.

L. Cleaning:

1. Wash thoroughly using clean water and soap. Rinse with clean water.

2. Do not use acid solution, steel wool, or other harsh abrasive.

3. If stain remains after washing, restore in accordance with recommendations of manufacturer, or replace handrails with an acceptable finish.

3.4 CLEANUP

A. Upon completion of installing the handrails and railings, clean up all waste materials and debris resulting from this operation and dispose of such waste materials and debris off the site.

* * * * * *

SECTION 09800
PROTECTIVE COATING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the protective coating of all specified surfaces not specifically included under the requirements of Section 09905 "Architectural Paint Finishes," including all surface preparation, pretreatment, coating application, touch-up of factory-coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

B. The following surfaces shall not be protective coated hereunder unless shown or specified herein, or elsewhere in the Contract Documents.

1. Concrete.

2. Stainless steel.

3. Machined surfaces.

4. Grease fittings.

5. Glass.

6. Equipment nameplates.

7. Maintenance hole frames and covers.

8. Platform gratings, stair treads, door thresholds, and other walk surfaces.

C. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE (Not Used)

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. References herein to "SSPC Specifications" or "SSPC" shall mean the published standards of the Steel Structures Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213.

B. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

C. Comply with the reference specifications of the GENERAL REQUIREMENTS.

D. Comply with the current provisions of the following Codes and Standards.

1. Commercial Standards:

ANSI A13.	Scheme for Identification of Piping Systems.
ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape-Hot-Applied.
ANSI/AWWA D102	Painting Steel Water-Storage Tanks

2. Federal Specifications:

TT-P-28F	Paint, Aluminum, Heat Resisting (1200F)

1.4 CONTRACTOR SUBMITTALS

A. Submittals shall be made in accordance with the GENERAL REQUIREMENTS.

B. Samples: The Contractor shall submit samples of all paint, finishes, and other coating materials specified herein, in accordance with the GENERAL REQUIREMENTS. Paint or coating samples shall be submitted on 8-1/2-inch by 11-inch sheet metal. Each sample shall be completely coated over its entire surface with one protective coating material, type, and color.

C. Coating Materials List: The Contractor shall provide 8 copies of a coating materials list which indicates the manufacturer and the coating number, keyed to the coating systems herein, prior to or at the time of submittal of samples.

D. Paint Manufacturer's Information: For each paint system to be used the Contractor shall submit the following listed data at least 30 days prior to painting.

1. Paint manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Paint manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product (where applicable).

4. Compatibility of shop and field applied coatings (where applicable).

5. Material safety data sheet for each product used.

6. Two sets of color samples to match each color selected by the Engineer from the manufacturer's standard color sheets. If custom mixed colors are required by this Section, the color samples shall be made using color formulations prepared to match the color samples furnished by the Engineer. The color formula shall be shown on the back of each color sample.

E. Manufacturer's Certification: For submerged and severe service coating systems, the Contractor shall require the paint manufacturer to certify to the following:

1. The manufacturer's representative has provided at least 6 hours of on-site instruction in the proper surface preparation, use, mixing, application, and curing of the coating systems.

2. The manufacturer's representative has personally observed the start of surface preparation, mixing, and application of the coating materials.

F. The Contractor shall submit all such certificates to the Engineer within 7 days of completion of each paint system.

G. Applicator's Certificate and Report: For submerged and severe service coating systems, the Contractor shall require the applicator of the protective paint coatings to certify to the following:

1. Immediately before painting, surfaces conformed to the specified preparation; they were in the specified condition; and were clean, dry, and free of dust, rust, and mill scale.

2. Surface preparation and coating use, mixing, application, and curing were done in accordance with the current printed instructions and recommendations of the protective coating manufacturer, and these Specifications.

3. The products specified were used and a listing of the names of the products and their manufacturer.

4. The products were used within the shelf-life dates, stating the shelf-life dates of each container of each product used.

5. The specified dry film thickness of coatings are on the items.

6. The quantities of each product used with copies of paint manufacturer's invoice.

7. Compatible paints were used where shop or field applied coatings are applied over previously-applied coatings.

8. The applicator's certificate shall list the dates and locations that the coating work was completed for the various surfaces coated, and shall also list the dry film thickness obtained for each coat. The Contractor shall submit said paint applicator's certificates to the Engineer within 7 days after completion of each paint system.]

1.5 QUALITY ASSURANCE

A. General: The Contractor shall give the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work of coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

B. All such work shall be performed only in the presence of the Engineer, unless the Engineer has granted prior approval to perform such work in its absence.

C. Inspection by the Engineer, or the waiver of inspection of any particular portion of the work, shall not relieve the Contractor of its responsibility to perform the work in accordance with these Specifications.

D. Where protective coatings are to be performed by a subcontractor, said subcontractor [must possess a valid state license as required for performance of the painting and coating work called for in this specification and] must provide 5 references which show that the painting subcontractor has previous successful experience with the specified or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the painting subcontractor provided the protective coating.

E. Scaffolding shall be erected and moved to locations where requested by the Engineer to facilitate inspection. Additional illumination shall be provided to cover all areas to be inspected.

F. Inspection Devices: The Contractor shall furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Dry-film thickness gages shall be made available for the Engineer's use at all times while coating is being done, until final acceptance of such coatings. The Contractor shall provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the Engineer.

G. Holiday Testing: The Contractor shall holiday test all coated ferrous surfaces inside a steel

reservoir, or other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.

1. Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as [Tinker & Rasor Model AP-W], [D.E. Stearns Co. Model 14/20], or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

2. Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: [Tinker & Rasor Model M1 non-destructive type holiday detector], [K-D Bird Dog], or equal shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10 and 20 mils, a non-sudsing type wetting agent, such as [Kodak Photo-Flo], or equal, shall be added to the water prior to wetting the detector sponge.

H. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gage such as [Mikrotest model FM], [Elcometer model 111/1EZ], or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gage.

I. Surface Preparation: Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

1.6 MANUFACTURER REPRESENTATIVE

A. The Contractor shall require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as specified in the paragraph entitled "Manufacturer's Certification", herein, and as may be necessary to resolve field problems attributable or associated with the manufacturer's products furnished under this Contract or the application thereof.

1.7 MAINTENANCE

A. Warranty Inspection: A warranty inspection may be conducted during the eleventh month following completion of all coating and painting work. The Contractor and a representative of the coating material manufacturer shall attend this inspection. All defective work shall be repaired in accordance with these specifications and to the satisfaction of the City. The City may, by written notice to the Contractor, reschedule the warranty inspection, or may cancel the warranty inspection altogether. If a warranty inspection is not held the Contractor is not relieved of its responsibilities under the Contract Documents.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Definitions: The term "paint", "coatings", or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General: Coating materials shall be sealed in containers that plainly show the designated name,

formula or specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer, all of which shall be plainly legible at the time of use.

C. The Contractor shall use coating materials suitable for the intended use and recommended by their manufacturer for the intended service.

D. Compatibility: In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the Engineer, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors: All colors and shades of colors of all coats of paint shall be as selected or specified by the Engineer. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. [Finish colors shall be as selected from the manufacturer's standard color samples by the Engineer.] [Finish colors shall be custom mixed to match color samples furnished by the Engineer.

F. Protective Coating Materials: Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the Contractor shall provide the Engineer with the names of not less than 10 successful applications of the proposed manufacturer's products demonstrating compliance with this specification requirement.

G. Substitute or "Or-Equal" Submittals: Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed. The Contractor shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or-equal" material that said material meets the specified requirements and is equivalent or better than the listed materials in the following properties:

1. Quality
2. Durability
3. Resistance to abrasion and physical damage
4. Life expectancy
5. Ability to recoat in future
6. Solids content by volume
7. Dry film thickness per coat
8. Compatibility with other coatings
9. Suitability for the intended service
10. Resistance to chemical attack
11. Temperature limitations in service and during application
12. Type and quality of recommended undercoats and topcoats
13. Ease of application
14. Ease of repairing damaged areas

15. Stability of colors

H. The cost of all testing and analyzing of the proposed substitute materials that may be required by the Engineer shall be paid by the Contractor. If the proposed substitution requires changes in the contract work, the Contractor shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 INDUSTRIAL COATING SYSTEMS

A. Material Sources: Each of the following manufacturers is capable of supplying many of the industrial coating materials specified herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials must be shown to satisfy the material descriptions and to equal or exceed the properties of the listed materials as required in the paragraph entitled "Substitute or `Or-Equal' Submittals" herein.

1. Carboline Coatings Company

2. PPG Paints, Ameron

3. Sherwin Williams Company

4. Tnemec Company

B. System 1 – Not Used

C. System 2 - Not Used

System 3 - Not Used

D. System 4 - Aliphatic Polyurethane: Two component aliphatic acrylic or polyester polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering and with a minimum solids content of 58 percent by volume. Primer shall be a rust inhibitive two component epoxy coating with a minimum solids content of 70 percent by volume.
If this coating system is to be used on Galvanized Ferrous Metal; provide surface treatment (or approved equal) for the prime coat as per the Coating Manufacturers product data sheet.

1. Prime coat (Min DFT = 4 mils), [Amerlock 400], [Carboguard 890], [SW Macropoxy 646-100], [Tnemec L69 Epoxoline], or equal.

2. Finish coat (one or more, Min DFT = 3 mils), [Amershield], [Carboline 133 MC], [SW Sherloxane 800], [Tnemec 740 EverThane], or equal.

3. Total system Min DFT = 7 mils.

4. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.

E. System 5 - Inorganic Zinc/Epoxy/Polyurethane: The inorganic zinc primer shall be a water or solvent based, self-curing, zinc silicate 2-component inorganic coating which contains at least 85 percent of metallic zinc by weight in the dried film, and is recommended by the coating manufacturer as a primer for this system. The intermediate coat shall be a high-build two component epoxy with a solids content of at least 70 percent by volume. Finish coats shall be a 2-component aliphatic acrylic or polyester polyurethane coating material that provides superior color and gloss retention, resistance to chemical fumes and severe weathering, and a minimum solids content of 58 percent by volume.

1. Prime coat (Min DFT = 2 mil), Dimetcote 21-5/4A], [Carbo Zinc 11 WB, SW Corothane Galvapac 2k 100] Tnemec 94H2O Hydro- Zinc, or equal.

2. Intermediate coat (Min DFT = 4 mils), Amerlock 400, Carboline 890, SW Macropoxy 646-100, Tnemec L69 Epoxoline, or equal.

3. Finish coats (one or more, Min DFT = 3 mils), Amershield, Carboline 133 MC, SW Sherloxane 800], Tnemec 740 EverThane, or equal.

4. Total system DFT = 9 mils.

5. Intermediate coat shall be applied in excess of 4 mils DFT or in more than one coat as necessary to completely cover the inorganic zinc primer and prevent application bubbling of the polyurethane finish coat.

6. More than one finish coat shall be applied as necessary to produce a finish with uniform color and texture.

F. System 6 - Inorganic Zinc, Water Based: Water based, self curing, ethyl silicate shall be a two component inorganic coating material that contains at least 85 percent of metallic zinc by weight in the dried film.

1. Prime coat and finish coat (one, Min DFT = 3 mils), Dimetcote 21- 5/4 A, Carbozinc 11 WB, SW Zinc Clad XI, or equal.

2. Total system DFT = 3 mils.

G. System 7 – Acrylic Enamel: Single component, water based acrylic coating with a fungicide additive shall have a minimum solids content of 35 percent by volume. Prime coat shall be as recommended by manufacturer. The coating material shall be available in the ANSI safety colors.

1. Prime coat (Min DFT = 2 mils), as recommended by manufacturer.

2. Finish coats (2 or more, Min DFT = 6 mils), Amercoat 2104, Carboline 3359 MC, SW Pro Industrial Acrylic, Tnemec 1028 Enduratone, or equal.

3. Total system DFT = 8 mils.

H. System 8 - Not Used

I. System 9 - Not Used

J. System 10 – Acrylic Enamel, Concrete: High molecular weight acrylic coating material shall have a minimum solids content of 35 percent by volume. Prime coat shall be an acrylic filler and sealer for concrete surfaces.

1. Prime coat (Filler/sealer)(Min DFT = 12 mils), Tnemec 180 Tneme-Crete, Sanitile 100, [SW Heavy Duty Block Filler, or equal.

2. Finish coats (2 or more, Min DFT = 4 mils), Tnemec 180 Tneme- Crete, Carbocrylic 3359 MC, SW Pro Industrial Acrylic (DFT = 6 mils) or equal.

K. System 11 - Aliphatic Polyurethane, Concrete: Two component aliphatic polyester polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering, and with a minimum solids content of 58 percent by volume. Filler-sealer compound shall be a two-component epoxy material used to provide a smooth surface for the epoxy intermediate coat.

The filler-surfacer is applied to the entire concrete surface and worked into the concrete surface with a wide blade putty knife or squeegee. The intermediate coat shall be a high-build polyamide epoxy coating with a minimum solids content of 70 percent by volume.

1. Prime coat (Filler-sealer), NU-Klad 114A, Carboguard 501. SW Steel Seam FT 910, Tnemec 215 Surfacing Epoxy, or equal.

2. Intermediate coat (Min DFT = 4 mils), Amerlock 400, Carboguard 60, Macropoxy 646-100, Tnemec L69 Epoxoline, or equal.

3. Finish coats (1 or more, Min DFT = 3 mils), Amershield, Carbothane 133 MC, SW Sherloxane 800, Tnemec 740 Everthane, or equal.

L. System 12 - Aliphatic Polyurethane, Fiberglass: Two-component aliphatic polyurethane coating material shall provide superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering. A primer, tie coat, or mist coat shall be used as recommended by the manufacturer.

1. Prime coat (Tie coat) (Min DFT= 2 mils), Sanitile 120, SW Macropoxy 646-100, Tnemec P69 Epoxoline, or equal.

2. Finish coats (1 or more, Min DFT = 3 mils), Amershield, Carbothane 133 MC, SW Sherloxane 800, Tnemec 740 Everthane, or equal.

N. Max VOC levels per SCQAMD noted in Section 2.5

2.3 SUBMERGED AND SEVERE SERVICE COATING SYSTEMS

A. Materials Sources: The manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. If proposed materials are not listed below, the requirements of the paragraph entitled "Substitute or `Or-Equal' Submittals" apply. In addition, the Contractor shall submit for consideration a list of at least 10 installations with similar service conditions for which the proposed substitute or "or-equal" products have shown satisfactory performance for at least several years including the name, address, and phone number of the owner of each installation.

B. System 100 - Amine Cured Epoxy Lining: High build, amine cured, straight epoxy resin shall have a solids content of at least 80 percent by volume, manufactured in accordance with ANSI 61 Standards as test by NSF, and shall be suitable for long-term immersion service in potable water, raw water, and non-potable water. The material shall conform to Food and Drug Administration regulations for food additives.

1. Prime coat and finish coats (1 or more, Minimum DFT = 20 mils), Phenoline 341 Amercoat 133, SW Duraplate UHS, Sherplate PW, Tnemec 22 Pota-Pox, or equal.

C. System 101 – Epoxy: High-build, amine or polyamide cured, epoxy resin shall have a solids content of at least 70 percent by volume, comply with local VOC regulations, and shall be suitable for exposures to chlorine vapors, fumes, and incidental splash or spill of chemicals. Total thickness 8- 12 mills DFT.

1. Prime Coat (DFT= 4-6 mils) Carboguard 890, SW Macropoxy 646-100, Tnemec L140F Pota-Pox, or equal.

2. Topcoat (DFT = 4-6 mils) Carboguard 890, SW Macropoxy 646-100, Tnemec l140F Pota-Pox, or equal.

D. System 102 – Epoxy Mortar: High-build, 3-component amine cured epoxy mortar, shall have a solids content of 100 percent by volume, suitable for long-term immersion and atmospheric exposure to wastewater. Filler-resurfacing compound shall be a 3-component epoxy cementitious thin overlay material used to fill voids and rough areas and must feather-edge capable. Epoxy Glaze (finish) coat shall bea 100 percent solids epoxy suitable for long-term immersion and atmospheric exposure to wastewater.

1. Filler / Resurfacing Overlay (Thickness = minimum 1/16”), SW Duraplate 2300, Tnemec 218 MortarClad, or equal.

2. Epoxy Mortar (Minimum DFT = 125 mils) SW Duraplate 6100, Tnemec 434 Perma-Shield, or equal.

3. Finish coat (DFT = 15-20 mils), SW Duraplate 6100, Tnemec 435 Perma-Glaze], or equal.

E. System 103 - Coal Tar Epoxy: High build, 2-component amine cured coal tar epoxy shall have a solids content of at least 68 percent by volume, suitable for coating of buried surfaces, and conforming to DOD-P-23236, Class 2, or to SSPC Paint 16. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field.

1. Prime coat (Min DFT = 1.5 mils).

2. Finish coats (2 or more, Min DFT = 16 mils), SW Targuard CTE 100, Carboguard 888 or 330M, or equal

3. Total system DFT = 17.5 mils.

F. System 104 - Coal Tar Epoxy Substitute, Concrete: High build, 2-component amine cured epoxy, shall have a solids content of at least 80 percent by volume, suitable for long term immersion for coating of buried surfaces. Product performance shall be equivalent to DOD-P-23236, Class 2, or to SSPC Paint 16. Filler surfacing compound shall be a 2-component epoxy material used to fill voids and rough areas. The seal coat provides a smooth surface for the application of the amine cured epoxy. The seal coat is a two-component epoxy material with 100 percent solids and is applied to the entire concrete surface and worked into the concrete surface with a wide blade putty knife or a squeegee.

1. Seal coat, Carboguard 501, SW Steel Seam FT910, Tnemec Series 215], or equal.

2. Finish coats (1 or more, Min DFT = 25 mils) Phenoline 341 or Plascite 4500, Amercoat 133, SW Duraplate UHS, Tnemec Series 22 or equal.

G. System 105 - Inorganic Zinc/Epoxy:

1. Inorganic Zinc Primer: Water or solvent based, self-curing 2-component inorganic coating shall contain a minimum of 85 percent metallic zinc by weight in the dried film and is recommended by the coating manufacturer as a primer for the epoxy material.

2. Polyamide Cured Epoxy: High build polyamide cured epoxy coating shall have a solids content of at least 70 percent by volume and a finish coat color of white. The material shall be capable of achieving at least 4 mils dry film thickness per coat.

3. Amine Cured Epoxy: High build amine cured epoxy coating shall have a solids content of at least 80 percent by volume and with a finish coat color of white or ivory. The material shall be capable of achieving at least 5 mils dry film thickness per coat.

4. The epoxy coating material shall be a straight epoxy resin and shall be either a polyamide-

cured epoxy or an amine-cured epoxy suitable for long-term immersion service in potable water. The material shall conform to Food and Drug Administration regulations for food additives and state and local health regulations and policies for service in potable water reservoirs. The Contractor shall submit a written certification that the proposed materials meet the above regulatory agency standards and policies. The material shall be applied with a primer if recommended by the coating manufacturer.

5. Part A: Products shall be as listed, or equal:

a.	Pre-coating, prior to erection. (DFT = 3 mils) See Note (1) under Paragraph f.		Dimetcote 9, Carboline Zinc, SW Corothane Galvapac, Tnemec 94-H2O Hydro-Zinc
	Touch up, following erection. (DFT = 3 mils) See Note (2) under Paragraph f		SW Corothane Galvapac, Tnemec 94-H2O Hydro-Zinc
b.	Difficult-to-coat areas, following erection. See Note (3) underline Paragraph f .		Amercoat 395, Macropoxy 5500LT, Carbo-859, Tnemec L140F Pota-Pox.
c.	Finish Coats (2 or more)	(DFT = 8 mils)	Amercoat 395, Macropoxy 5500LT, Carbo-859 Tnemec L140F Pota-Pox.

d. Total system DFT = 7 mils

e. Notes:

(1) All lap roof plate edges are to be pre-coated. If necessary, zinc primer exposed on exterior of roof may be removed prior to welding.

(2) Touch-up coating shall be done for areas damaged during erection, or areas not pre-coated. The Contractor shall spot sandblast to SSPC-SP-5 before application of coating. Material used for touch-up shall be a compatible solvent based inorganic or organic zinc primer recommended by the manufacturer.

(3) All edges, nuts, bolts, lap joints, weld seams and the roof rim angle shall receive one brush-applied coat prior to the application of the complete spray coat.

6. Part B: Products shall be as listed, or equal:

a.	Difficult-to-coat areas. See Note (1) under Paragraph d.		Amercoat 395, Phenoline 341, SW Macropoxy 5500LT, Tnemec L140F Pota-Pox.
b.	Finish coats (2 or more). See Note (1) under Paragraph d.	(DFT = 12 mils)	Amercoat 395, Phenoline 341, SW Macropoxy 5500LT, Tnemec L140F Pota-Pox.

c. Total system DFT = 12 mils

d. Notes:

(1) All edges, nuts, bolts, lap joints, and weld seams shall receive one brush-applied coat prior to the application of the first complete spray coat.

7. Curing Period: Prior to immersion, the completed system shall be subjected to at least 240 hours of curing time with the metal temperature at a minimum of 70 degrees F, or 480 hours at a minimum of 60 degrees F, both conditions at a maximum relative humidity of 50 percent and under the forced ventilation conditions required by the paragraph entitled "Curing of Coatings, herein. More curing time or a higher temperature shall be provided if recommended by the epoxy coating manufacturer. If the environmental conditions do not provide the necessary minimum temperature, use heated air to provide the necessary heat for curing. Other combinations of curing time and temperature may be used if the coating manufacturer presents satisfactory documentation and test results to substantiate that the degree of curing is equal or greater than curing for 240 hours at 70 degrees F.

8. Volatile Organic Compound Testing: The completed interior reservoir coating system shall be tested for volatile organic compounds as specified herein.

H. System 106 - Fusion Bonded Epoxy: The coating material shall be a 100 percent powder epoxy applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines", except that the surface preparation shall be as specified in the coating system schedule of this Section. The coating shall be applied using the fluidized bed process.

1. Liquid Epoxy: For field repairs or where, as confirmed by the Engineer, it would be impossible to use the powder epoxy method without causing damage to the item, the use of a liquid epoxy will be permitted, applied in not less than 3 coats to provide a DFT of 15 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the powder epoxy manufacturer.

2. Coating (Min DFT = 16 mils), [Scotchkote 206N], [SW Pipeclad 2000], or equal.

3. Total system DFT = 16 mils.

I. System 107 - Chemical Resistant Sheet Lining:

1. Materials: The Contractor shall use natural rubber, chlorobutyl, or neoprene sheet lining materials as specified herein. The shop drawing submittal shall contain technical information that confirms the suitability of the lining material system for long-term immersion in each chemical to be stored. The service temperatures are expected to be up to 150 degrees F.

2. Neoprene sheet lining material shall be synthetic rubber formulated for steam curing at atmospheric pressure. The minimum lining thickness shall be 3/16-inch. The lining material shall be ~~[B.F. Goodrich compound 59688]~~,[ ], or equal.

3. Chlorobutyl sheet lining material shall be synthetic rubber formulated for steam curing at atmospheric pressure. The minimum lining thickness shall be 3/16-inch. The lining material shall be [~~B.F. Goodrich compound 60924], [~~], or equal.

4. Natural rubber (soft) sheet lining material shall be soft natural rubber formulated for steam curing at atmospheric pressure. The minimum lining thickness shall be 3/16-inch. The lining material shall be [B~~.F. Goodrich compound 83160~~],[ ], or equal.

5. Natural rubber (hard) sheet lining material shall be a hard, natural rubber resistant to oxidizing agents and formulated for autoclave curing. The minimum lining thickness shall be 3/16-inch. The lining material shall be [~~B.F. Goodrich compound~~ 8631],[ ], or equal.

6. Primers, adhesives, activators, accelerators and other necessary materials shall be as specified by the sheet material manufacturer.

7. Metal Surface Preparation: Prior to abrasive blast cleaning the base metal shall be prepared as specified by the sheet lining material manufacturer's installation instructions. If the instructions differ from these specifications the highest degree of cleaning and surface preparation shall be provided. Abrasive blast cleaning shall be done in accordance with this Section.

8. Installation of lining materials shall be in accordance with the material manufacturer's written installation instructions. All interior surfaces shall be lined, including all piping, vents, fittings, flange faces, maintenance hole covers and blind flanges.

9. The lining system shall be holiday tested in accordance with this Section before and after curing.

10. The lining system shall be cured by steam using the time and temperature as specified by the material manufacturer.

11. Extended Maintenance: The Contractor shall promptly repair any defects in the lining system for a period of two years after the lining has been placed into service. Such maintenance shall include repair of the chemical tank and any equipment or facilities damaged by the corrosive action of the chemicals.

J. System 108 - Not Used

K. System 109 – Epoxy - Amine, Epoxy-amine cured resin with a solids content of at least 100 percent by volume, and suitable for long-term immersion in wastewater and exposure to the effects of hydrogen sulfide gas where there is the probability of sulfuric acid formation on the surfaces

1. Prime coat and finish coats (1 or more, Minimum DFT 20 mils), Tnemec 435 Perma-Glaze, SW Duraplate 6100], or equal

L. System 110 - Epoxy - Amine, Concrete: Epoxy- amine cured resin with a solids content of at least 55 percent by volume, and suitable for long-term immersion in wastewater and exposure to the effects of hydrogen sulfide gas where there is the probability of sulfuric acid formation on the surfaces. The filler-sealer shall be a 100 percent solids amine cured epoxy material with silica and inert fillers. A 100 percent solids epoxy surfacer shall be used to fill holes and patch the concrete surfaces after abrasive blasting.

1. Prime coat (filler-sealer)(1 or more, applied to the entire surface using a squeegee to achieve a smooth, void-free surface), Carboguard 501, Nu-Klad 114A, SW Steel Seam FT910, Tnemec 218 MortarClad, or equal.

2. Finish coats, manholes, (1 or more, Minimum DFT = 120 mils), Plasite 4500-S, Sigma Novoguard 840, SW Duraplate 6100, Tnemec 435 PermaGlaze or equal.

3. Finish coats, wastewater, (1 or more, Minimum DFT = 30 mils), Plasite 4500-S, Sigma Novoguard 840, SW Duraplate 6100, Tnemec 435 PermaGlaze or equal.

4. Finish coats, stairways and walkways, (2 or more, Minimum DFT = 15 mils per coat)(provide aluminum oxide, non-skid broadcast between coats), Plasite 4500-S, Sigma Novoguard 840], Plascite 4500-S, SW Duraplate 6100, Tnemec 435 Permaglaze, or equal.

M. System 111 – Not Used

N. System 112 - Vinyl Ester-Concrete: Vinyl ester resin coating material with an inert flake pigment suitable for immersion service in hydrochloric acid and sulfuric acid solutions. The filler-sealer shall be a 100 percent solids amine-cured epoxy or vinyl ester material with silica and inert fillers. The filler-sealer is applied to the entire concrete surface. A 100 percent solids epoxy or vinyl ester surfacer shall be used to fill holes and patch the concrete surface after abrasive blasting.

1. Prime coat (filler-sealer), applied to achieve a smooth void-free surface.

2. Finish coats (two or more, Minimum DFT = 40 mils), [SW Cor Cote VEN], Tnemec 120 Vinester, or equal.

O. Max VOC levels per SCQAMD noted in Section 2.5

2.4 SPECIAL COATING SYSTEMS

A. System 200 - PVC Tape: Prior to wrapping the pipe with PVC tape, the pipe and fittings first shall be primed using a primer recommended by the PVC tape manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half-lapped, to a total thickness of 40 mils.

B. System 201 - Rich Portland Cement Mortar: Rich Portland cement mortar coating shall have a minimum thickness of 1/8-inch, followed by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped and sealed with tape.

C. System 203 - Epoxy Surfacing: Two-component epoxy floor surfacing mortar shall be formulated to resist many acids, alkalies, and solvents. Novolac finish material shall be resistant to liquid alum, sodium hydroxide, and 50 percent sulphuric acid. Finish coats shall be a minimum 20 mils dry film thickness over mortar surfacing. Products shall be as follows, or equal:

1. Ameron Alternative: Prime coat Amerlock Sealer; finish coat Nu-Klad 110A, (1/4-inch thick).

2. SW Alternative: Prime coat [TPM 115]; finish coat [GP 3741 Novoflo (1/4-inch thick).

3. Carboline Alternative: Prime coat Carboguard 501, finish coat Semstone 140 (¼ inch thick, 250 mils DFT).

4. Tnemec Alternative: Prime coat Tnemec 237 Power- Tread; finish Tnemec 282 Tneme-Glaze (1/4-inch thick).

D. System 204 - Waterproofing: Two coats of a clear, non-staining, silane-modified-siloxane masonry waterproofing material. The waterproofing system 204 after application shall be provided with not less than a five-year warranty on the performance of the product.

1. Where EPA Allows Solvents: Chemstop, "WB Heavy Duty"; Rainguard, "XS", Chemprobe/ Prime a Pell H2O; or equal.

2. Where EPA Prohibits Solvents: Chemstop, "WB Regular / Heavy Duty"; Rainguard's "Blok-Lok"; Rainproof's "Chem-Trete #45", Chemprobe/Prime A Pell H2O; or equal.

Surfaces shall be cleaned with a chemical (approved by waterproofing manufacturer) cleaner and power wash. Surfaces shall be clean and dry before application of waterproofing. Method and rate of application shall be in accordance with manufacturer's published instructions. A manufacturer's representative shall be present during applications if necessary. for warranty.

E. System 205 - Polyethylene Encasement: Application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

F. System 206 - Cement Mortar Coating: A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than one part Type V cement to 3 parts sand. The cement mortar shall be cured by a

curing compound meeting the requirements of "Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C 309-81, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped by at least 6-inches.

G. System 207 - Non-Slip Surfacing: Coating shall have one coat of Semstone 140 W/ aluminum oxide additive, AS 150 as manufactured by Amstep Products] or one coat of Ameron Nu-Klad 100A with Amercoat 886 additive, or one coat SW Fastop TC with AO, or one coat Tnemec 280 Tneme-Glaze with Series 211 additive] or equal. The coating shall be gray in color. Application shall be by means of a roller and not more than 60 sq. ft per gallon of non-slip coating shall be applied. Primer shall be as recommended by the coating manufacturer.

H. System 208 - Aluminum Metal Isolation: A wash primer (0.5 mils) shall be applied, followed by one coat of heavy bodied bituminous paint, such as SW Macropoxy 646-100, Tnemec L69 Epoxoline, or equal (8 mils). Total thickness of system (8.5 mils).

I. Max VOC levels per SCQAMD noted in Section 2.5

2.5 MAXIMUM VOLATILE ORGANIC COMPOUND LIMITS (SCQAMD - 2016)

TABLE OF STANDARDS 1
VOC LIMITS

Grams of VOC Per Liter of Coating, Less Water and Less Exempt Compounds

COATING CATEGORY	Category Codes	Current Limit[1]	Effective Date			Small Container Exemption
			1/1/14	2/5/16	1/1/19	
Bond Breakers	5	350				✓
Building Envelope Coating	62	100			50	✓
Concrete-Curing Compounds	7	100				✓
Concrete-Curing Compounds For Roadways and Bridges[2]	7	350				✓[3]
Concrete Surface Retarder	58	50	50			✓
Default	51	50	50			✓
Driveway Sealer	52	50				✓
Dry-Fog Coatings	8	50	50			✓
Faux Finishing Coatings						
Clear Topcoat	9a	100	100			✓
Decorative Coatings	9	350				✓
Glazes	9b	350				✓
Japan	9c	350				✓
Trowel Applied Coatings	9d	50	50			✓
Fire-Proofing Coatings	10	150	150			✓
Flats	13	50				✓[5]
Floor Coatings	14	50				✓
Form Release Compound	16	100	100			✓
Graphic Arts (Sign) Coatings	17	200	150	200		✓
Industrial Maintenance (IM) Coatings	19	100				✓[5]
Color Indicating Safety Coatings		480				✓[5]
High Temperature IM Coatings	18	420				✓[5]
Non-Sacrificial Anti-Graffiti Coatings	19a	100				✓[5]
Zinc-Rich IM Primers	56	100				✓[5]
Magnesite Cement Coatings	22	450				✓[3]
Mastic Coatings	23	100	100			✓
Metallic Pigmented Coatings	24	150	150			✓
Multi-Color Coatings	25	250				✓[3]
Nonflat Coatings	26, 27, 28	50				✓[5]
Pre-Treatment Wash Primers	29	420				✓[3]
Primers, Sealers, and Undercoaters	30	100				✓
Reactive Penetrating Sealers	59	350				✓[4]
Recycled Coatings	33	250			150	✓
Roof Coatings	34	50				✓
Roof Coatings, Aluminum	53	100				✓
Roof Primers, Bituminous	4	350				✓[3]
Rust Preventative Coatings	35	100				✓[6]
Sacrificial Anti-Graffiti Coatings	60	50				✓[3]
Shellac						
Clear	37	730				✓[4]
Pigmented	38	550				✓[4]
Specialty Primers	39	100				✓
Stains	41	100				✓

COATING CATEGORY	Category Codes	Current Limit[1]	Effective Date			Small Container Exemption
			1/1/14	2/5/16	1/1/19	
Stains, Interior	40	250				✓
Stone Consolidants	61	450				✓[3]
Swimming Pool Coatings						
Repair	43	340				✓[3]
Other	42	340				✓[3]
Tile and Stone Sealers	63	100				✓
Traffic Coatings	45	100				✓
Tub and Tile Refinishing Coatings	64	420				✓[4]
Waterproofing Sealers	48	100				✓
Waterproofing Concrete/Masonry Sealers	49	100				✓
Wood Coatings		275				
Varnish	46, 47	275				
Sanding Sealers	36	275				
Lacquer	20	275				
Wood Conditioners	65	100				
Wood Preservatives						
Below-Ground	50	350				✓[3]
Other	55	350				✓[3]

1. The specified limits remain in effect unless revised limits are listed in subsequent columns in the Table of Standards.
2. Does not include compounds used for curbs and gutters, sidewalks, islands, driveways and other miscellaneous concrete areas.
3. Effective 02/05/2016, the small container exemption no longer applies per (f)(1).
4. Effective 01/01/2018, the small container exemption no longer applies per (f)(1).
5. Effective 01/01/2019, the small container exemption is further restricted per (f)(1).
6. Effective 01/01/2020, the small container exemption is further restricted per (f)(1).

TABLE OF STANDARDS 1 (cont.)
VOC LIMITS

Grams of VOC Per Liter of Material

COATING	Limit
Low-Solids Coating	120

TABLE OF STANDARDS 2
VOC LIMITS FOR COLORANTS

Grams of VOC Per Liter of Colorant
Less Water and Less Exempt Compounds

COLORANT ADDED TO	Limit
Architectural Coatings, excluding IM Coatings	50
Solvent-Based IM	600
Waterborne IM	50

PART 3 -- EXECUTION

3.1 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations: Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed. The Contractor shall supply the Engineer with copies of each manufacturer's instructions in accordance with the GENERAL REQUIREMENTS.

B. All protective coating materials shall be used within the manufacturer's recommended shelf life.

C. Storage and Mixing: Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.2 PREPARATION FOR COATING

A. General: All surfaces to receive protective coatings shall be cleaned as specified herein prior to application of said coatings. The Contractor shall examine all surfaces to be coated, and shall correct all surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touch-up restoration prior to any coating application.

B. Protection of Surfaces Not to be Coated: Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.

C. All hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.

D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The Contractor shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. Protection of Painted Surfaces: Cleaning and coating shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

3.3 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification:

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, dirt, soil, salts, and contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, and loose paint to degree specified, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, and loose paint to degree specified by power tool chipping, descaling, sanding, wire brushing, and grinding.

4. White Metal Blast Cleaning (SSPC-SP5/NACE1): Removal of all visible rust, mill scale, paint, and foreign matter by blast cleaning by wheel or nozzle (dry or wet) using sand, grit, or shot.

5. Commercial Blast Cleaning (SSPC-SP6/NACE3): Blast cleaning until at least two-thirds of each element of surface area is free of all visible residues.

6. Brush-Off Blast Cleaning (SSPC-SP7/NACE4): Blast cleaning of all except tightly adhering residues of mill scale, rust, and coatings, exposing numerous evenly distributed flecks of underlying metal.

B. The other surface preparation standards shall be the most recent versions published by the SSPC and NACE.

3.4 METAL SURFACE PREPARATION (UNGALVANIZED)

A. The minimum abrasive blasting surface preparation shall be as specified in the coating system schedules included at the end of this Section. Where there is a conflict between these specifications and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.

B. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70.

C. All oil, grease, welding fluxes and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 prior to blast cleaning.

D. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth prior to blast cleaning.

E. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions.

F. The abrasive shall not be reused unless otherwise approved by the Engineer. For automated shop blasting systems, clean oil-free abrasives shall be maintained.

G. The Contractor shall comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

H. Compressed air for air blast cleaning shall be supplied at adequate pressure from well maintained compressors equipped with oil/moisture separators which remove at least 95 percent of the contaminants.

I. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming or another approved method prior to painting.

J. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.

K. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.

L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2, hand tool cleaning or SSPC-SP3, power tool cleaning, may be used.

M. Shop applied coatings of unknown composition shall be completely removed before the specified coatings are applied. Valves, castings, ductile or cast-iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast

cleaning work has been started.

N. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

O. Ferrous metal surfaces in severe or immersion service shall conform to the following.

1. Solvent Cleaning (SSPC-SP1) shall be performed over all surfaces prior to abrasive blast cleaning. : Removal of oil, grease, dirt, soil, salts, and contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam as required.

2. All ferrous metal and non-ferrous metal surfaces to be cleaned in accordance with SSPC-SP5/NACE 1. White Metal Blast Clean with a 3.0 mil minimum anchor profile.

3. Where the coating is specified to be terminated, the Contractor shall prepare and apply materials as outlined in coating manufacturer recommendations.

4. Where the coating is specified to be terminated at a metal embedment, the Contractor shall prepare and apply materials as outlined or as recommended by the manufacturer.

5. The Contractor shall notify the Engineer should jobsite conditions prevent the above operations and/or applications

3.5 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A. Galvanized ferrous metal shall be alkaline cleaned per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of the protective coating system to be used.

B. Abrasive brush blasting or uniform scarification of cleaned surfaces is required. Perform surface preparation according to SSPC-SP16, Brush of Blast Cleaning of Coated and Uncoated Galvanized steel, Stainless Steel, and Non-Ferrous Metals.

C. Abrasive brush blasting is required for all non-ferrous metals in severe or immersion service.

D. Pretreatment coatings, white rust staining, passivation treatments such as chromating shall be completely removed. Perform successful test to confirm removal of passivating treatments according to SSPC-Sp16 prior to the application of any coatings.

3.6 SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS

A. General: All grease, oil, heavy chalk, dirt, or other contaminants shall be removed by solvent or detergent cleaning prior to abrasive blast cleaning. The generic type of the existing coatings shall be determined by laboratory testing.

B. Abrasive Blast Cleaning: The Contractor shall provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not specified in the schedule, deteriorated coatings shall be removed by abrasive blast cleaning to SSPC-SP6, Commercial Blast Cleaning. Areas of tightly adhering coatings shall be cleaned to SSPC-SP7, Brush-off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

C. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings the Contractor shall apply intermediate coatings per the paint manufacturer's recommendation for the specified coating system or shall completely remove the existing coating prior to abrasive blast cleaning. A small trial application shall be conducted for compatibility prior to painting large areas.

D. Unknown Coatings: Coatings of unknown composition shall be completely removed prior to application of new coatings.

E. Water Abrasive or Wet Abrasive Blast Cleaning: Where specified or where job site conditions do not permit dry abrasive blasting for industrial coating systems due to dust or air pollution considerations, water abrasive blasting or wet abrasive blasting may be used. In both methods, paint-compatible corrosion inhibitors shall be used, and coating application shall begin as soon as the surfaces are dry. Water abrasive blasting shall be done using high pressure water with sand injection. In both methods, the equipment used shall be commercially produced equipment with a successful service record. Wet blasting methods shall not be used for submerged and severe service coating systems unless specified.

3.7 CONCRETE AND CONCRETE BLOCK MASONRY SURFACE PREPARATION

A. Surface preparation shall not begin until at least 30 days after the concrete or masonry has been placed.

B. All oil, grease, and form release and curing compounds shall be removed by detergent cleaning per SSPC-SP1 before abrasive blast cleaning.

C. Concrete, concrete block masonry surfaces and deteriorated concrete surfaces to be coated shall be abrasive blast cleaned to remove existing coatings, laitance, deteriorated concrete, and to roughen the surface equivalent to the surface of the No. 80 grit flint sandpaper.

D. If acid etching is required by the coating application instructions the treatment shall be made after abrasive blasting. After etching, rinse surfaces with water and test the pH. The pH shall be between neutral and 8.

E. Surfaces shall be clean and as recommended by the coating manufacturer before coating is started.

F. Unless required for proper adhesion, surfaces shall be dry prior to coating. The presence of moisture shall be determined with a moisture detection device such as Delmhorst Model DB, or equal.

G. Concrete, Concrete Masonry Unit surfaces in sever or immersion service shall conform to the following.

1. Remove all release agents, curing compounds, efflorescence, chalk, grease, and foreign material from the surface. Surfaces shall be decontaminated to remove all microorganisms, acid constituents, grease, oil, and other contaminants prior to commencement of surface preparation (Reference ASTM D4258, SSPC-SP13/NACE No. 6).

2. Verify that the pH of the cleaned and prepared concrete surfaces to be coated is within the range of to 9 to 11. Application of coating materials outside this range will not be permitted without written approval from the Engineer. ASTM D 4262 should be used to determine pH.

3. Allow new concrete to cure for a minimum of 28 days or shall be prepared and treated according to the coating manufacturer’s recommendations.

4. Test concrete for moisture following the 28-day curing period in accordance with ASTM D4263 and/or F1869. Test results shall be reviewed by the coating manufacturer’s technical representative to determine if any special treatments are required prior to the application of coating.

5. Concrete surfaces shall be prepared in accordance with SSPC-SP13/NACE No. 6, Severe Service, and shall produce a minimum surface profile of a CSP-5 as noted in ICRI Technical Guideline No. 310.2 and ASTM D4259, SSPC-SP13/NACE No. 6.

6. Fill all bug holes, honeycombs, cracks, and surface imperfections with surface fillers to the specified thickness in a uniform and consistent fashion.

7. Where the coating is specified to be terminated, the contractor shall prepare and apply materials as outlined by the coating manufacturer. Detailed drawings shall be provided for review with contractor submittals.

8. Repair of spalling, corroded concrete, exposed rebar shall be performed according to the specified process and manufacturer's recommendation.

3.8 PLASTIC, FIBERGLASS AND NONFERROUS METALS SURFACE PREPARATION

A. Plastic and fiberglass surfaces shall be sanded or brush off blast cleaned prior to solvent cleaning with a chemical compatible with the coating system primer.

B. Non-ferrous metal surfaces shall be solvent-cleaned SSPC-SP1 followed by sanding or brush-off blast cleaning SSPC-SP7/NACE4.

C. All surfaces shall be clean and dry prior to coating application.

3.9 ARCHITECTURAL CONCRETE BLOCK MASONRY SURFACE PREPARATION

A. The mortar surfaces shall be cured at least 14 days before surface preparation work is started.

B. Dust, dirt, grease, and other foreign matter shall be removed prior to abrasive blasting.

C. The masonry surfaces shall be prepared in accordance with the material manufacturer's printed instructions.

3.10 WORKMANSHIP

A. Skilled craftsmen and experienced supervision shall be used on all work.

B. Clean drop cloths shall be used. All damage to surfaces resulting from the work hereunder shall be cleaned, repaired, and refinished to their original condition.

C. All coatings shall be applied under dry and dust-free conditions. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure they have been thoroughly cleaned and that they receive an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other approved precautionary measures.

3.11 SHOP COATING REQUIREMENTS

A. All items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the specified or approved color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires top coating within a specified period of time, the equipment shall be finish coated in the shop and then touch-up painted after installation.

B. All items of equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.

C. The interior surfaces of steel reservoirs shall have all surface preparation and coating work performed in the field.

D. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the specified quality in the field. Such equipment shall be shop primed and finish coated and touched up in the field with the identical material after installation. The Contractor shall require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.

E. For certain small pieces of equipment, the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

F. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 6 months before top coated, or less time if recommended by the coating manufacturer.

G. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturers printed instructions.

H. The Contractor shall make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

3.12 APPLICATION OF COATINGS

A. The application of protective coatings to steel substrates shall be in accordance with "Paint Specification No. 1, (SSPC-A-1)", Steel Structures Painting Council.

B. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. The Contractor shall schedule such inspection with the Engineer in advance.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Finish coats, including touch-up and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.

H. Coatings shall not be applied under the following conditions:

1. Temperature exceeding the manufacturer's recommended maximum and minimum

allowable.

2. Dust or smoke laden atmosphere.

3. Damp or humid weather.

4. When the substrate or air temperature is less than 5 degrees F above dewpoint.

5. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.

I. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychrometric tables.

J. Steel piping shall be abrasive blast cleaned and primed before installation.

K. The finish coat on all work shall be applied after all concrete, masonry, and equipment installation is complete and the work areas are clean and dust free.

3.13 CURING OF COATINGS

A. The Contractor shall provide curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the highest requirement, prior to placing the completed coating system into service.

B. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.

C. Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures: Forced air ventilation is required for the application and curing of coatings on the interior surfaces of steel reservoirs and enclosed hydraulic structures. During curing periods continuously exhaust air from a maintenance hole in the lowest shell ring, or in the case of an enclosed hydraulic structure, from the lowest level of the structure using portable ducting. After all interior coating operations have been completed provide a final curing period for a minimum of 10 days, during which the forced ventilation system shall operate continuously. For additional requirements, refer to the specific coating system being used in the paragraph entitled "Submerged and Severe Service Coating Systems" herein.

3.14 TESTING FOR VOLATILE ORGANIC COMPOUNDS IN POTABLE WATER RESERVOIRS

A. General: The Contractor shall provide the following services to ensure that the interior reservoir coatings or linings do not convey volatile organic compounds to the potable water.

B. Selection of Coating or Lining Material: The Contractor shall provide a coating or lining system that has a successful record in meeting the national, regional, and local regulations and policies pertaining to leaching of volatile organic compounds into potable water.

C. Before the coating or lining materials are used, the Contractor shall by letter notify the regulatory agency having jurisdiction. The letter shall describe the proposed materials, including brand names, catalog numbers, catalog technical data, application and curing instructions, and material safety data sheets.

D. The Contractor shall provide curing time, temperature and ventilations as specified by the manufacturer or this Section, whichever is the highest requirement. In some cases, the Contractor may find it necessary to extend the curing time or ventilation time beyond the requirements in order to comply with the regulatory agency requirements or to reduce the leached organic compounds to the required levels. All costs in connection with any extended curing times shall be borne by the Contractor.

E. Following the curing or ventilation period, the Contractor shall clean, disinfect and fill the reservoir as specified.

F. A 7-day soaking period shall follow initial filling to determine the presence of any leached organics. Before the tank is placed into service, samples of the water in the tank will be taken by the Engineer and analyzed by a laboratory approved by the State or the EPA. Analyses will be for volatile organic compounds by EPA Method 624 or equivalent (this test includes TCE, PCE, xylenes, toluene, ketones, carbon tetrachloride, and similar compounds).

G. If the tests results are above either (1) 0.005 mg/l for TCE, 0.004 mg/l for PCE, 0.62 mg/l for xylenes, 0.10 mg/l for toluene, 0.75 mg/l for methyl-ethyl ketone (to be used as representative for all ketone compounds), 0.005 mg/l for carbon tetrachloride, or (2) the regulatory agency's recommended Action Level Limits, whichever is less, the Contractor shall drain the water from the tank and flush, refill, and retest at no additional cost to the City. The Contractor shall provide as many curing, soaking, and flushing cycles as necessary to reduce the leached volatile organic compounds to levels below the requirements.

3.15 IDENTIFICATION OF PIPING

A. Identification of piping shall be in accordance with Section [15780] "Treatment Plant Piping Identification Systems."

B. Every valve or connection, where it may be possible for a worker to be exposed to a hazardous substance, shall be labeled per [General Industry Safety Orders, Article 112] OSHA Occupational Safety and Health Standards 29CFR1910.

C. All unburied pipe in structures and in chemical pipe trenches shall be color-code painted. Colors shall be as specified in Section [15780] "Treatment Plant Piping Identification Systems," as selected by the Engineer, or as shown.

D. [All unburied chemical pipes, including chemical pipes in structures and chemical pipe trenches shall be color-code painted. Colors shall be as specified in Section [15780] "Treatment Plant Piping Identification Systems," as selected by the Engineer, or as shown.]

3.16 COATING SYSTEM SCHEDULES - FERROUS METALS

A. Coating System Schedule, Ferrous Metal - Not Galvanized:

	Item	Surface Prep.	System No.
FM-1	All exposed surfaces indoors and outdoors, except those included below.	Commercial blast cleaning SSPC-SP6/NACE3	(7) acrylic enamel
FM-1	All exposed surfaces indoors and outdoors, except those included below.	Commercial blast cleaning SSPC-SP6/NACE3	(4) aliphatic polyurethane
FM-1	All exposed surfaces indoors and outdoors, except those included below.	White metal blast cleaning SSPC-SP5/NACE1	(5) zinc-rich / polyurethane
FM-2	Surfaces in chlorination room, chlorine storage room.	Commercial blast cleaning SSPC-SP6/NACE3	(101) epoxy
FM-3	Surfaces of equipment and ferrous surfaces submerged or intermittently submerged	White metal blast cleaning SSPC-SP5/NACE1	(100) amine cured epoxy

	in potable water or utility water, including all surfaces lower than 2-feet above high water level and all surfaces inside enclosed hydraulic structures and vents (excluding shop-coated valves, couplings, pumps).		
FM-4	Surfaces of equipment and ferrous surfaces submerged or intermittently submerged in wastewater, including all surfaces lower than 2-feet above high water level and all surfaces inside enclosed hydraulic structures (excluding shop-coated valves, couplings, pumps).	White metal blast cleaning SSPC-SP5/NACE1	(109) epoxy amine
FM-5	Surfaces exposed to high temperature (between 150 and 600 degrees F).	White metal blast cleaning SSPC-SP10/NACE1	(6) inorganic zinc,water-based
FM-6	Surfaces exposed to high temperature (between 600 and 1000 degrees F).	white metal blast cleaning SSPC-SP5/NACE1	(3) aluminum silicone resin
FM-7	Buried small steel pipe.	Removal of dirt, grease, oil	(200) PVC tape
FM-8	Buried pipe couplings, valves, and flanged joints (where piping is plastic).	Removal of dirt, grease, oil	(201) rich portland cement mortar
FM-9	Buried pipe couplings, valves, and flanged joints (where piping is not plastic, or tape-coated, or mortar-coated steel), including epoxy-coated surfaces.	As specified by reference specification	(205) polyethylene encasement
FM-10	Buried pipe couplings, valves, and flanged joints (where piping is mortar-coated steel or reinforced concrete), including epoxy-coated surfaces.	Removal of dirt, grease, oil	(206) cement-mortar coating
FM-11	Ferrous surfaces in water passagaes of all valves 4-inch size and larger, exterior surfaces of submerged valves.	White metal blast cleaning SSPC-SP5/NACE1	(100) amine-cured epoxy
FM-12	Where shown or specified, ferrous surfaces in water passages and submerged surfaces of all pumps which have discharge size of 4-	White metal blast cleaning SSPC-SP5/NACE1	(100) amine-cured epoxy

	inches or larger.		
FM-12	Where shown or specified, ferrous surfaces in water passages and submerged surfaces of all pumps which have discharge size of 4-inches or larger.	White metal blast cleaning SSPC-SP5/NACE1	(106) fusion-bonded epoxy]
FM-13	Ferrous surfaces of sleeve-couplings	White metal blast cleaning SSPC-SP5/NACE1	(100) amine-cured epoxy
FM-14	All ferrous surfaces of sluice gates, flap gates, and shear gates, including wall thimbles.	White metal blast cleaning SSPC-SP5/NACE1	(106) fusion-bonded epoxy
FM-15	Buried surfaces that are not specified to be coated	White metal blast cleaning SSPC-SP5/NACE1	(103) coal tar epoxy
FM-16	Indoor sheet metal, flashings, exposed ducts.	Commercial blast cleaning SSPC-SP6/NACE3	(7) acrylic enamel
FM-17	Interior surfaces of all chemical tanks, except caustic soda tanks, including tank nozzles, manholes, nozzle necks, flange faces.	White metal blast cleaning SSPC-SP5/NACE1	(107) chemical-resistant sheet lining
FM-18	Surfaces of indoor equipment.	[Specifier enter]	[Specifier enter]
FM-19	Specifier list of existing ferrous equipment or surfaces which are required to be re-coated as part of this work.	[Specifier enter]	[Specifier enter]

B. Coating System Schedule, Ferrous Metal - Galvanized: Pretreatment coatings, barrier coatings, or washes shall be applied as recommended by the coating manufacturer. [All galvanized surfaces shall be coated] [All galvanized surfaces except for the following items shall be coated unless coating is required by other Sections: (1) Floor gratings and frames, (2) Handrails, (3) Stair treads, (4) Chain link fencing and appurtenances, (5) Specifier selected items].

	Item	Surface Prep.	System No.
[FMG-1	All exposed surfaces indoors and outdoors, except those included below.	Galvanized Metal	(3) acrylic enamel]
[FMG-1	All exposed surfaces indoors and outdoors, except those	Galvanized Metal	(4) aliphatic polyurethane

	below.		
FMG-2	Surfaces in chlorinator room, chlorine storage room.	Galvanized Metal	(101) amine-cured epoxy
FMG-3	Buried small steel pipe.	Galvanized Metal	(200) PVC tape
FMG-4	Surfaces buried or submerged in wastewater.	Galvanized Metal	(109) epoxy-amine
FMG-5	Buried miscellaneous surfaces, couplings, valves, and flanged joints.	Galvanized Metal	(201) rich portland cement mortar
FMG-6	Indoor sheet metal flashings, exposed ducts.	Galvanized Metal	(3) acrylic enamel
FMG-7	[Specifier list of existing galvanized equipment or surfaces which are required to be recoated as part of this work.]	[Specifier enter]	[specifier enter]

C. Coating System Schedule, Steel Reservoir Interior: For steel reservoir exterior coating system, see "Coating System Schedule, Ferrous Metal-Not Galvanized". The interior surfaces of steel reservoirs shall have all surface preparation and coating work performed in the field.

	Item	Surface Prep.	System No.
[SR-1	All interior surfaces beginning one foot above high water level, including all plates, roof structural members, fittings, and vents.	White metal blast cleaning SSPC-SP5/NACE1	(105) Part A, inorganic zinc/epoxy
SR-2	Underside of column bases, floor under column bases before columns set in place, submerged contact surfaces that are not accessible after erection.	White metal blast cleaning SSPC-SP5/NACE1	(105) Part B, inorganic zinc/epoxy
SR-3	Interior surfaces exclusive of surfaces in SR-1 and SR-2 above, including overflow, drain and other piping out to the first valve or coupling.	White metal blast cleaning SSPC-SP5/NACE1	(105) Part B, inorganic zinc/ epoxy]

D. Coating System Schedule, Steel Digester Floating Covers and Digester Gasholders:

	Item	Surface Prep.	System No.
SD-1	All ferrous surfaces submerged in water or	White metal blast cleaning SSPC-SP5/NACE1	(109) epoxy amine

	sludge, including rim plate.		
SD-2	All ferrous surfaces exposed to digester gas.	White metal blast cleaning SSPC-SP5/NACE1	(109) epoxy amine
SD-3	All interior ferrous surfaces of gasholder shell, including top angle.	White metal blast cleaning SSPC-SP5/NACE1	(109) epoxy amine
SD-4	All ungalvanized interior surfaces inside digester roof, between and including the ceiling plate and the roof deck.	White metal blast cleaning SSPC-SP5/NACE1	(109) epoxy amine
SD-5	Exposed, outdoors.	Commercial blast cleaning SSPC-SP6/NACE3	(5) Zinc rich, aliphatic polyurethane

3.17 COATING SYSTEM SCHEDULE, NON-FERROUS METAL, PLASTIC, FIBERGLASS

A. Where isolated non-ferrous parts are associated with equipment or piping, the Contractor shall use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames or hatches. Only primers recommended by the coating manufacturer shall be used.

	Item	Surface Prep.	System No.
[NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC-P1	(3) acrylic enamel]
[NFM-1	All exposed surfaces, indoors and outdoors, except those included below.	Solvent cleaned SSPC-P1	(4) aliphatic polyurethane]
NFM-2	Chlorination room, chlorine storage room.	Solvent cleaned SSPC-SP1	(101) amine-cured epoxy
NFM-3	Aluminum surfaces in contact with concrete, or with any other metal except galvanized ferrous metal.	Solvent cleaned SSPC-SP1	(208) aluminum metal isolation
NFM-4	Polyvinyl chloride plastic piping, indoors and outdoors, or in structures, not submerged.	Solvent cleaned SSPC-SP1	(7) acrylic enamel
NFM-5	Fiber glass surfaces.	Per Paragraph [3.8]	(12) aliphatic polyurethane fiberglass
NFM-6	Buried non-ferrous metal pipe.	Removal of dirt, grease, oil	(200) PVC tape
NFM-7	[Specifier list of existing	[Specifier enter]	[Specifier enter]

equipment or surfaces which are required to be recoated as part of this work.]

3.18 COATING SYSTEM SCHEDULE-CONCRETE

	Item	Surface Prep.	System No.
C-1	Exposed indoors and outdoors, as shown.	Per Paragraph [3.7]	(10) acrylic, concrete
[C-2	Submerged in wastewater including surfaces up to 2-feet above high water line and down to 2-feet below low water line and all surfaces in an enclosed structure, as shown.	Per Paragraph [3.7]	New surface:(110) epoxy amine, concrete Existing surface: (102) epoxy mortar
[C-2	Submerged in wastewater including surfaces up to 2-feet above high water line and down to 2-feet below low water line and all surfaces in an enclosed structure, as shown.	Per Paragraph [3.7]	(110) epoxy amine, concrete
C-3	Floor slab, exposure to chemicals, as shown.	Per Paragraph [3.7]	(203) epoxy surfacing
C-4	Floor slab, non-slip surface, as shown.	Per Paragraph [3.7]	(207) non-slip surfacing
[C-5	Interior surfaces of sewer manholes, including sidewalls, bottom, and metal appurtenances, for manholes shown.	Per Paragraph [3.7]	New surface:(110) epoxy amine, concrete Existing surface: (102) epoxy mortar
[C-5	Interior surfaces of sewer manholes, including sidewalls, bottom, and metal appurtenances, for manholes shown.	Per Paragraph [3.7]	New surface:(110) epoxy amine, concrete Existing surface: (102) epoxy mortar
C-6	Walls, exposure to chemical splash, washdown, as shown.	Per Paragraph [3.7]	(11) aliphatic polyurethane, concrete
C-7	[Specifier list of existing concrete surfaces which are required to be recoated as part of this work and as shown.]	[Specifier enter]	[Specifier enter]

3.19 COATING SYSTEM SCHEDULE-CONCRETE BLOCK MASONRY

	Item	Surface Prep.	System No.
CBM-1	Exposed, indoors and outdoors, as shown.	Per Paragraph [3.9]	(10) acrylic, concrete
[CBM-2	Submerged in wastewater, including all vertical masonry surfaces above waterline as shown.	Per Paragraph [3.9]	New surface:(110) epoxy amine, concrete Existing surface: (102) epoxy mortar
[CBM-2	Submerged in wastewater, including all vertical masonry surfaces above waterline as shown.	Per Paragraph [3.9]	New surface:(110) epoxy amine, concrete Existing surface: (102) epoxy mortar
CBM-3	Exterior surfaces, above grade.	Per Paragraph [3.9]	(204) waterproofing
CBM-4	[Specifier list of existing masonry surfaces which are required to be recoated as part of this work, and as shown.]	[Specifier enter]	[Specifier enter]

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