

Final Construction Document Specifications

For

IERBYS Temporary Improvements Site

**Interurban Electric Railway
Bridge Yard Shop
Oakland, CA**



Contract Number: 04-0120F4

May 3rd, 2013

HNTB

STAMP SHEET

The special provisions contained herein have been prepared by or under the direction of the following registered persons.

STRUCTURES


REGISTERED CIVIL ENGINEER



ARCHITECTURE

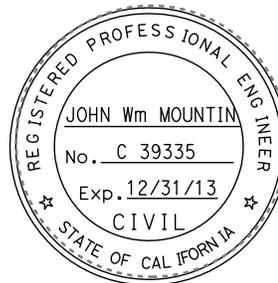

REGISTERED ARCHITECT



CIVIL ENGINEER

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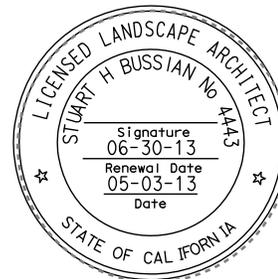
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DOCUMENT 000110

TABLE OF CONTENTS

INTRODUCTORY INFORMATION

000101 Project Title Page
000110 Table of Contents

GENERAL REQUIREMENTS SUBGROUP

DIVISION 01 - GENERAL REQUIREMENTS

011420 Construction Site Management (Cal-Trans Spec)
013530 Health and Safety Plan (Cal-Trans Spec)
017420 Handling, Transportation, and Disposal of Contaminated Material (Cal-Trans Spec)

FACILITY CONSTRUCTION SUBGROUP

DIVISION 02 - EXISTING CONDITIONS

024100 Demolition

DIVISION 03 - CONCRETE

031100 Concrete Forming
031500 Concrete Accessories
032000 Concrete Reinforcing
033000 Cast-In-Place Concrete
033500 Concrete Finishing
036111 Non-Shrink Grout

DIVISION 04 - MASONRY

042200 Concrete Masonry Units

DIVISION 05 - METALS

053000 Metal Deck
055000 Metal Fabrications
057000 Decorative Metal
057300 Stainless Steel Railings
058100 Expansion Joint Cover Assemblies

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

061500 Wood Decking

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

076000 Flashing and Sheet Metal
079200 Joint Sealants

DIVISION 08 - OPENINGS

081100 Metal Doors and Frames
087100 Door Hardware
089100 Louvers

DIVISION 09 - FINISHES

099000 Painting and Coating

DIVISION 10 - SPECIALTIES

101453 Traffic Signage

DIVISION 11 - EQUIPMENT

NOT USED

DIVISION 12 - FURNISHINGS

129313 Bicycle Racks

DIVISION 13 - SPECIAL CONSTRUCTION

130000 Site Seating – Wood Spools

DIVISION 14 - CONVEYING EQUIPMENT

NOT USED

DIVISION 20 – UNDERGROUND UTILITIES

205016 Underground Ductwork and Structures for Facility Services

**FACILITY SERVICES SUBGROUP
DIVISION 21 – FIRE SUPPRESSION**

NOT USED

DIVISION 22 – PLUMBING

224713 Drinking Fountain

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

NOT USED

DIVISION 25 – INTEGRATED AUTOMATION

NOT USED

DIVISION 26 - ELECTRICAL

NOT USED

DIVISION 27 - COMMUNICATIONS

NOT USED

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

NOT USED

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 31 – EARTHWORK

310000 Earthwork
311000 Clearing and Grubbing

DIVISION 32 – EXTERIOR IMPROVEMENTS

321123 Aggregate Base Course
321216 Asphalt Paving
321313 Concrete Paving
321621 Concrete Curbs, Gutters and Walks
321713 Parking Bumpers
321723 Pavement Markings
321726 Detectable Warning Tactiles
321813 Synthetic Lawn
323113 Chain Link Fences and Gates

DIVISION 33 – UTILITIES

330525 Support and Protection of Utilities
330528 Trenching and Backfilling for Utilities
330535 Protection, Removal and Abandonment of Utility Pipes

SECTION 011420
CONSTRUCTION SITE MANAGEMENT

PART 1 - WASTE MANAGEMENT

1.1 SOLID WASTE

- A. Do not allow litter, trash, or debris to accumulate anywhere on the job site, including storm drain grates, trash racks, and ditch lines. Pick up and remove litter, trash, and debris from the job site at least once a week. The WPC manager must monitor solid waste storage and disposal procedures on the job site.
- B. If practicable, recycle nonhazardous job site waste and excess material. If recycling is not practicable, dispose of it under Section 7-1.13, "Disposal of Materials Outside the Highway Right of Way," of the Standard Specifications.
- C. Furnish enough closed-lid dumpsters of sufficient size to contain the solid waste generated by work activities. When refuse reaches the fill line, empty the dumpsters. Dumpsters must be watertight. Do not wash out dumpsters at the job site. Furnish additional containers and pick up dumpsters more frequently during the demolition phase of construction.
- D. Solid waste includes:
 - 1. Brick
 - 2. Mortar
 - 3. Timber
 - 4. Metal scraps
 - 5. Sawdust
 - 6. Pipe
 - 7. Electrical Cuttings
 - 8. Nonhazardous equipment parts
 - 9. Styrofoam and other packaging materials
 - 10. Vegetative material and plant containers from highway planting
 - 11. Litter and smoking material, including litter generated randomly by the public
 - 12. Other trash and debris
- E. Furnish and use trash receptacles in the job site yard, field trailers, and locations where workers gather for lunch and breaks.

1.2 HAZARDOUS WASTE AND CONTAMINATION

- A. If hazardous waste is, or will be, generated on the job site, the WPC manager must be thoroughly familiar with proper hazardous waste handling and emergency procedures under 40 CFR § 262.34(d)(5)(iii) and must have successfully completed training under 22 CA Code of Regs § 66265.16.
- B. The WPC manager must:
 - 1. Oversee and enforce hazardous waste management practices
 - 2. Inspect all hazardous waste storage areas daily, including all temporary containment facilities and satellite collection locations
 - 3. Oversee all hazardous waste transportation activities on the job site
- C. Submit a copy of uniform hazardous waste manifest forms to the Engineer within 24 hours of transporting hazardous waste.
- D. Submit receiving landfill documentation of proper disposal to the Engineer within 5 business days of hazardous waste transport from the project.

1.3 UNANTICIPATED DISCOVERY OF ASBESTOS AND HAZARDOUS SUBSTANCES

- A. Upon discovery of asbestos or hazardous substance, comply with Section 14-11.02 "Asbestos and Hazardous Substances," of the Standard Specifications.

1.4 HAZARDOUS WASTE MANAGEMENT PRACTICES

- A. Handle, store, and dispose of hazardous waste under 22 CA Code of Regs Div 4.5.
- B. Use the following storage procedures:
1. Store hazardous waste and potentially hazardous waste separately from nonhazardous waste at the job site.
 2. For hazardous waste storage, use metal containers approved by the United States Department of Transportation for the transportation and temporary storage of hazardous waste.
 3. Store hazardous waste in sealed, covered containers labeled with the contents and accumulation start date under 22 CA Code of Regs, Div 4.5. Labels must comply with the provisions of 22 CA Code of Regs, Div 4.5. § 66262.31 and § 66262.32. Immediately replace damaged or illegible labels.
 4. Handle hazardous waste containers such that no spillage occurs.
 5. Store hazardous waste away from storm drains, watercourses, moving vehicles, and equipment.
 6. Furnish containers with adequate storage volume at convenient satellite locations for hazardous waste collection. Immediately move these containers to secure temporary containment facilities when no longer needed at the collection location or when full.
 7. Store hazardous waste and potentially hazardous waste in secure temporary containment enclosures having hours. Temporary containment enclosures must be located away from public access. Acceptable secure enclosures include a locked chain link fenced area or a lockable shipping container located within the project limits.
 8. Design and construct secondary containment facilities with a capacity to contain precipitation from a 24- hour-long, 25-year storm; and 10 percent of the aggregate volume of all containers, or the entire volume of the largest container within the facility, whichever is greater.
 9. Cover secondary containment facilities during non-working days and if a storm event is predicted. Secondary containment facilities must be adequately ventilated.
 10. Keep secondary containment facility free of accumulated rainwater or spills. After a storm event, or in the event of spills or leaks, collect accumulated liquid and place into drums within 24 hours. Handle these liquids as hazardous waste unless testing determines them to be nonhazardous.
 11. Do not store incompatible wastes, such as chlorine and ammonia, in the same secondary containment facility.
 12. Provide sufficient separation between stored containers to allow for spill cleanup or emergency response access. Storage areas must be kept clean, well-organized, and equipped with cleanup supplies appropriate for the wastes being stored.
 13. Repair or replace perimeter controls, containment structures, covers, and liners as necessary. Inspect storage areas before and after a storm event, and at least weekly during other times.
- C. Do not:
1. Overfill hazardous waste containers
 2. Spill hazardous waste or potentially hazardous waste
 3. Mix hazardous wastes
 4. Allow hazardous waste or potentially hazardous waste to accumulate on the ground

- D. Dispose of hazardous waste within 90 days of the start of generation. Use a hazardous waste manifest and a transporter registered with the DTSC and in compliance with the CA Highway Patrol Biennial Inspection of Terminals Program to transport hazardous waste to an appropriately permitted hazardous waste management facility.

1.5 DUST CONTROL FOR HAZARDOUS WASTE OR CONTAMINATION

- A. Excavation, transportation, and handling of material containing hazardous waste or contamination must result in no visible dust migration. Have a water truck or tank on the job site at all times while clearing and grubbing and performing earthwork operations in work areas containing hazardous waste or contamination.

1.6 STOCKPILING OF HAZARDOUS WASTE OR CONTAMINATION

- A. Do not stockpile material containing hazardous waste or contamination unless ordered. Stockpiles of material containing hazardous waste or contamination must not be placed where affected by surface run-on or run-off. Cover stockpiles with 13 mils minimum thickness of plastic sheeting or 1 foot of nonhazardous material. Do not place stockpiles in environmentally sensitive areas. Stockpiled material must not enter storm drains, inlets, or waters of the State.

1.7 CONTRACTOR-GENERATED HAZARDOUS WASTE

- A. You are the generator of hazardous waste generated as a result of materials you bring to the job site. Use hazardous waste management practices if you generate waste on the job site from the following substances:
 - 1. Petroleum materials
 - 2. Asphalt materials
 - 3. Concrete curing compound
 - 4. Pesticides
 - 5. Acids
 - 6. Paints
 - 7. Stains
 - 8. Solvents
 - 9. Wood preservatives
 - 10. Roofing tar
 - 11. Road flares
 - 12. Lime
 - 13. Glues and adhesives
 - 14. Materials classified as hazardous waste under 22 CA Code of Regs, Div 4.5
- B. If hazardous waste constituent concentrations are unknown, use a laboratory certified by the ELAP under the California Department Of Public Health to analyze a minimum of 4 discrete representative samples of the waste to determine whether it is a hazardous waste and to determine safe and lawful methods for storage and disposal. Perform sampling and analysis in compliance with US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) and under 22 CA Code of Regs, Div 4.5.
- C. Use your US EPA Generator Identification Number and sign hazardous waste manifests for the hazardous waste you generate.
- D. Identify contaminated soil resulting from spills or leaks by noticing discoloration, or differences in soil properties. Immediately notify the Engineer of spills or leaks. Clean up spills and leaks under the Engineer's direction and to the satisfaction of the Engineer. Soil with evidence of contamination must be sampled and analysis performed by a laboratory certified by ELAP.
- E. If sampling and analysis of contaminated soil demonstrates that it is a hazardous waste, handle and dispose of the soil as hazardous waste. You are the generator of hazardous waste created as the result of spills or leaks for which you are responsible.

- F. Prevent the flow of water, including ground water, from mixing with contaminated soil by using one or a combination of the following measures:
 - 1. Berms
 - 2. Cofferdams
 - 3. Grout curtains
 - 4. Freeze walls
 - 5. Concrete seal course

- G. If water mixes with contaminated soil and becomes contaminated, sample and analyze the water using a laboratory certified by the ELAP. If analysis results demonstrate that the water is a hazardous waste, manage and dispose of the water as hazardous waste.

1.8 DEPARTMENT-GENERATED HAZARDOUS WASTE

- A. If the Department is the generator of hazardous waste during the work performed on this project, use hazardous waste management practices
- B. Labels must comply with the provisions of 22 CA Code of Regs § 66262.31 and § 66262.32. Mark labels with:
 - 1. Date the hazardous waste is generated
 - 2. The words "Hazardous Waste"
 - 3. Composition and physical state of the hazardous waste (for example, asphalt grindings with thermoplastic or paint)
 - 4. The word "Toxic"
 - 5. Name, address, and telephone number of the Engineer
 - 6. Contract number
 - 7. Contractor or subcontractor name
- C. Handle the containers such that no spillage occurs.

1.9 HAZARDOUS WASTE TRANSPORT AND DISPOSAL

- A. Dispose of hazardous waste within California at a disposal site operating under a permit issued by the DTSC.
- B. The Engineer will obtain the US EPA Generator Identification Number for hazardous waste disposal.
- C. The Engineer will sign all hazardous waste manifests. Notify the Engineer 5 business days before the manifests are to be signed.
- D. The Department will not consider you a generator of the hazardous waste and you will not be obligated for further cleanup, removal, or remedial action for such material if handled or disposed of under these specifications and the appropriate State and federal laws and regulations and county and municipal ordinances and regulations regarding hazardous waste.

1.10 PAINT WASTE

- A. Clean water-based and oil-based paint from brushes or equipment within a contained area in a way that does not contaminate soil, receiving waters, or storm drain systems. Handle and dispose of the following as hazardous waste: paints, thinners, solvents, residues, and sludges that cannot be recycled or reused. When thoroughly dry, dispose of the following as solid waste: dry latex paint, paint cans, used brushes, rags, absorbent materials, and drop cloths.

1.11 CONCRETE WASTE

- A. Use practices to prevent the discharge of asphalt concrete, PCC, and HMA waste into storm drain systems and receiving waters.
- B. Collect and dispose of asphalt concrete, PCC, and HMA waste generated at locations where:
 - 1. Concrete material, including grout, is used

2. Concrete dust and debris result from demolition
3. Sawcutting, coring, grinding, grooving, or hydro-concrete demolition creates a residue or slurry
4. Concrete trucks or other concrete-coated equipment is cleaned at the job site

1.12 SANITARY AND SEPTIC WASTE

- A. Do not bury or discharge wastewater from a sanitary or septic system within the highway.
- B. A sanitary facility discharging into a sanitary sewer system must be properly connected and free from leaks.
- C. Place a portable sanitary facility at least 50 feet away from storm drains, receiving waters, and flow lines.
- D. Comply with local health agency provisions if using an on-site disposal system.

1.13 LIQUID WASTE

- A. Use practices that will prevent job-site liquid waste from entering storm drain systems and receiving waters.
- B. Liquid waste include the following:
 1. Drilling slurries or fluids
 2. Grease-free and oil-free wastewater and rinse water
 3. Dredgings, including liquid waste from cleaning drainage systems
 4. Liquid waste running off a surface, including wash or rinse water
 5. Other nonstormwater liquids not covered by separate permits
- C. Hold liquid waste in structurally sound, leak-proof containers, such as roll-off bins or portable tanks.
- D. Liquid waste containers must be of sufficient quantity and volume to prevent overflow, spills, and leaks.
- E. Store containers at least 50 feet from moving vehicles and equipment.
- F. Remove and dispose of deposited solids from sediment traps unless the Engineer approves another method.
- G. Liquid waste may require testing to determine hazardous material content before disposal.
- H. Dispose of drilling fluids and residue.
- I. If a location approved by the Engineer is available within the job site, fluids and residue exempt under 23 CA Code of Regs § 2511(g) may be dried by evaporation in a leak-proof container. Dispose of the remaining as solid waste.

END OF SECTION

SECTION 013530
HEALTH AND SAFETY PLAN

PART 1 - GENERAL

1.1 SUMMARY

- A. This work includes preparing, submitting, and implementing a detailed Health and Safety Plan that addresses the health and safety of all field personnel, including State personnel.
- B. The plan must identify potential health and safety hazards associated with existing hazardous substances and specifies work practices that must be used to protect workers from those hazards in conformance with the Department of Toxic Substances Control and CAL-OSHA regulations. At a minimum, the Health and Safety Plan must:
 - 1. Identify key site safety personnel
 - 2. Describe risks associated with the work
 - 3. Describe training requirements
 - 4. Describe appropriate personal protective equipment
 - 5. Describe any site-specific medical surveillance requirements
 - 6. Describe any periodic air monitoring requirements
 - 7. Define appropriate site work zones
 - 8. Describe any decontamination requirements
- C. The Health and Safety Plan must be submitted at least 15 business days before beginning work that may expose personnel to hazardous substances for review and acceptance by the Engineer. Before submittal, you must have the Health and Safety Plan approved by an industrial hygienist certified by the American Board of Industrial Hygiene.

1.2 SAFETY TRAINING

- A. Before performing work that may expose personnel to hazardous substances, all personnel, including State personnel, must complete a safety training program that communicates the potential health and safety hazards associated with work on the site and instructs the personnel in procedures for doing the work safely.
- B. The level of training provided must be consistent with the personnel's job function and conform to CAL-OSHA regulations.
- C. Do not start safety training until the Health and Safety Plan is accepted by the Engineer.
- D. Provide subsequent refresher training required until completion of the project.
- E. Provide a certification of completion of the safety training program to all personnel who successfully complete the training.
- F. Provide personal protective equipment required by State personnel to inspect the work.
- G. The number of State personnel requiring the above mentioned safety training program and personal protective equipment is 5.

END OF SECTION

SECTION 017420

HANDLING, TRANSPORTATION, AND DISPOSAL OF CONTAMINATED MATERIAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This work includes temporary storage, confirmation testing, transportation, and disposal of contaminated material. Comply with Section 19, "Earthwork," of the Standard Specifications. Test results used to determine the nature and extent of contaminated material are provided as described in "Supplemental Project Information," of these special provisions.

1.2 DEFINITIONS

- A. **Class II waste:** Contaminated material that is not regulated as a hazardous waste but requires handling as a designated waste under Water Code § 13173. Designated as roadway excavation (Class II). Does not include rock or pavement.
- B. **Resource Conservation and Recovery Act (RCRA):** Federal law that provides guidelines for managing solid waste.
- C. **Non-RCRA hazardous waste:** Contaminated material regulated as a hazardous waste under California law but not under RCRA. Also known as California hazardous waste. Designated as roadway excavation (Type H). Does not include rock or pavement.

1.3 SUBMITTALS

- A. Work Plan: At least 20 days before starting clearing and grubbing or earthwork at the job site, submit a workplan that includes:
 - 1. Schedule of activities
 - 2. Method of excavation and equipment to be used
 - 3. Dust control procedures
 - 4. Storage methods and locations for contaminated material
 - 5. Haul routes
 - 6. Spill contingency plan

The Engineer reviews the work plan within 15 days. Resubmit required revisions within 5 days. Do not start clearing and grubbing or earthwork until the plan is approved by the Engineer. No adjustment for time or money is made if resubmittals of the work plan are required due to deficiencies in the plan.

- B. **Waste Disposal Documents:** Submit a disposal facility waste disposal request for the Engineer's signature. Before transporting hazardous waste, submit a copy of the transporter's valid hazardous waste transporter registration. Submit completed waste shipment forms and disposal facility weight tickets within 35 days after shipment. The Department withholds payment until the completed forms are submitted.
- C. **Sampling and Analysis Plan:** At least 20 days before starting material sampling, submit a sampling and analysis plan (SAP). The SAP must be signed by a California registered professional engineer or California registered professional geologist experienced in contaminated site characterization. The SAP must include:
 - 1. Purpose and scope of the investigation, including:
 - a. Additional disposal facility requirements
 - b. Reclassification of material
 - c. Characterization of material outside of the excavation pay limits
 - 2. Sampling locations and methods
 - 3. Analytical methods

4. Name, address, and Environmental Laboratory Accreditation Program certification number of the testing laboratory
 5. Quality assurance/quality control procedures
- D. Base the sampling and analysis procedures on guidelines in:
1. USEPA, SW 846, "Test Methods for Evaluating Solid Waste, Volume II: Field Manual Physical/Chemical Methods"
 2. Methods"
 3. ASTM, D 1452, "Soil Investigation and Sampling by Auger Borings"
 4. ASTM, D 1586, "Penetration Test and Split-Barrel Sampling of Soils"
 5. ASTM, D 1587, "Thin-Walled Tube Sampling of Soils for Geotechnical Purposes"
 6. ASTM, D 6282-98(2005), "Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations"

The Engineer reviews the SAP within 15 days. Resubmit required revisions within 5 days. Do not start sampling until the plan is approved by the Engineer. No adjustment for time or money is made if resubmittals of the SAP are required due to deficiencies in the plan.

1.4 QUALITY CONTROL AND ASSURANCE

- A. **Regulatory Requirements:** Laws and regulations that govern this work include:
1. Health and Safety Code, Div 20, Ch 6.5 (California Hazardous Waste Control Act)
 2. 22 CA Code of Regs, Div 4.5 (Environmental Health Standards for the Management of Hazardous Waste)
 3. 8 CA Code of Regs
 4. Water Code § 13173
- B. **Permits and Licenses:** Obtain all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying hazardous waste, under Section 7-1.04, "Permits and Licenses," of the Standard Specifications.
- C. For hazardous waste disposal, the Engineer obtains the Environmental Protection Agency generator identification number and Board of Equalization identification number and signs all manifests as the generator.
- D. Notify the Engineer at least 5 days before starting waste transport and at least 24 hours before subsequent loads when there is a break in hauling of more than 5 days.

PART 2 - CONSTRUCTION

- A. Apply water to control dust at all times while performing clearing and grubbing or earthwork activities in work areas containing contaminated material. Apply water under Section 17, "Watering," of the Standard Specifications.
- B. Excavation, transportation, storage, and handling of contaminated material must result in no visible dust migration off the job site.
- C. Prevent mixing of contaminated material with uncontaminated material. No additional payment is made for material requiring reclassification because of failure to segregate the material after excavation.
- D. Characterization and disposal of additional material from excavations performed outside of the pay limits are included in the contract price for excavation. Assume the material has the same handling, transportation and disposal requirements as adjacent material. Furnish replacement material suitable for the planned use under Section 19, "Earthwork," of the Standard Specifications.
- E. Use material excavated to install individual (not duct bank) electrical and irrigation conduits to backfill the trenches.

2.1 TEMPORARY STORAGE

- A. Transfer contaminated material directly from the excavation to any of the following:
1. Transport vehicles
 2. Storage containers
 3. Stockpile locations approved by the Engineer
- B. Construct stockpile locations as follows:
1. The stockpiled material must not contain free liquids that separate readily.
 2. Furnish and place undamaged chemically resistant geomembrane liners.
 - a. Non-reinforced liner must be at least 20-mil thick.
 - b. Scrim-reinforced liner must have a minimum weight of 40 lbs/1000 square feet.
 3. Furnish and place undamaged geomembrane covers.
 - a. Non-reinforced liner must be at least 10-mil thick.
 - b. Scrim-reinforced liner must have a minimum weight of 26 lbs/1000 square feet.
 4. The dimensions of the geomembrane must exceed the dimensions of the stockpile at all times.
 5. Seal the seams in multiple geomembrane liners to prevent leakage.
 6. Cover stockpiles at the end of each day or before storm events to prevent windblown dispersion and precipitation run-off and run-on.
 7. If more than one sheet is required to cover the material, overlap the sheets a minimum of 1.5 feet.
 8. Secure the cover to keep it in place. Do not use driven anchors except at the perimeter of the stockpile. Inspection and maintenance must comply with "Water Pollution Control" of these special provisions.
- C. These stockpiling requirements apply to temporary storage outside of an excavation or a transport container including:
1. Staging of excavated material next to the excavation before pick up by loading equipment
 2. Accumulating material for full transport loads
 3. Awaiting test results required by a disposal facility

Start removing storage containers and stockpiles containing hazardous waste within 90 days of accumulating any quantity of material. After final removal has occurred, complete any cleanup required by the Engineer.

2.2 SAMPLING AND ANALYSIS

- A. Test the material for any additional acceptance requirements requested by the disposal facility or for confirmation of classifications specified on the plans or in the special provisions. Use sampling and analysis procedures approved by the Engineer and the disposal facility. Prepare and submit a sampling and analysis plan before starting any tests.
- B. The Engineer makes the final decision on reclassification or characterization of material after review of the test results. Allow 5 business days for review of test results. Changes in classification of materials will comply with Section 4-1.03, "Changes," of the Standard Specifications.

2.3 TRANSPORTATION

- A. Prepare a non-hazardous waste manifest or other shipping form for each load of Class II waste. Prepare a uniform hazardous waste manifest for each load of hazardous waste using the appropriate waste code. Transport hazardous waste using a transporter registered with the Department of Toxic Substances Control.
- B. Cover the cargo during transport to prevent spillage or dust release. You agree to indemnify the State from any cost or liability due to spillage during transport of contaminated material to a disposal facility.

2.4 DISPOSAL

- A. Dispose of contaminated material as follows:
 - 1. Roadway excavation (Class II) – Haul and dispose of the material at a permitted Class II waste management facility.
 - 2. Roadway excavation (Type H) – Haul and dispose of the material at a permitted non-RCRA hazardous waste management facility.
- B. Dispose of hazardous waste within California at a disposal site operating under a permit issued by the Department of Toxic Substances Control.
- C. Obtain waste disposal approval from the appropriate disposal facility. Type H material is eligible for an exemption from the Board of Equalization disposal fees as provided under Health and Safety Code §§ 25174.1 and 25174.7. Request a letter of exemption from the Engineer at least 5 days before transporting Type H material from within these limits to a disposal facility.

END OF SECTION

SECTION 024100

DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Permits.
- B. Site conditions.
- C. Materials, equipment, and facilities.
- D. Preservation of reference markers.
- E. Demolition.
- F. Removal.
- G. Salvage.
- H. Disposal of removed materials and debris.

1.02 RELATED SECTIONS

- A. Removal of vegetation and trees is specified in Section 31 11 00, Clearing and Grubbing.

1.03 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI A10.6 Safety Requirements for Demolition Operations
- B. State of California, Department of Transportation (Caltrans), Standard Specifications, Section 15, Existing Highway Facilities.

1.04 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing codes:
 - 1. California Code of Regulations (CCR), Title 8, Chapter 4, Subchapter 4 – Construction Safety Orders.
 - 2. California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 33, "Site Work, Demolition and Construction."

1.05 DESCRIPTION

- A. Demolition as follows:
 - 1. Buildings and structure foundations, footings, and foundation systems shall be completely removed.

2. Utility services to facilities to be removed or demolished shall be disconnected, cut, and capped.
- B. Removal of at-grade structures, such as existing pavements, curbs, gutters, sidewalks, and designated utility structures.

1.06 PERMITS

- A. The Contractor shall obtain all special permits and licenses and give all notices required for performance and completion of the demolition and removal work, hauling, and disposal of debris.

1.07 SUBMITTALS

- A. General: Submit in accordance with Section 5-1.01, "Working Drawings", of Special Provisions.
- B. Demolition Plan: Submit a comprehensive demolition plan, describing the proposed sequence, methods, and equipment for demolition, removal, and disposal of structure(s); include salvage if required. Do not proceed with demolition until the Engineer has given written approval of the demolition plan.
1. Shop Drawings: Include drawings in plan of all structures to be demolished. Indicate stages or phases of the demolition work.
- C. Permits: Submit copies of demolition, hauling, and debris disposal permits and notices for record purposes. Include description of proposed haul routes.
- D. Utility Severance Certificates: Provide certificates, issued by the utility owners, of severance of utility services for record purposes.
- E. Private Property Owner's Release: If material demolished and removed from the site will be deposited on private property, submit two copies of written releases not more than 15 days before the start of work. Releases shall absolve the District from responsibility in connection with the depositing of material on private property, and shall be signed by the owners of such property on which the material will be deposited.
- F. Record Documents: Provide copies of all approved submittals, specified herein, for record purposes in accordance with the requirements of Section 10-3.20, "Closeout Submittal" of Special Provisions

1.08 SITE CONDITIONS

- A. Protection of Persons and Property:
2. Erect and maintain temporary bracing, shoring, lights, barricades, signs, and other measures as necessary to protect the public, workers, and adjoining property from damage from demolition work, all in accordance with applicable codes and regulations.
 3. Open depressions and excavations occurring as part of this work shall be barricaded and posted with warning lights when accessible through adjacent property or through public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

4. Protect utilities, pavements, and facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by demolition operations.
5. Contractor should not store material or operate vehicles within 15 feet of EBMUD outfall centerline, located near south fence line.

B. Protection of Utilities:

1. Protect active sewer, water, gas, electric, and other utilities; and drainage and irrigation lines indicated or, when not indicated, found or otherwise made known to the Contractor before or during demolition work. If utility is damaged, immediately notify the utility owner for corrective action.
2. Arrange with and perform work required by utility companies and municipal departments for discontinuance or interruption of utility services due to demolition work.

C. Noise and Dust Abatement: Comply with requirements specified in Section 14 "Environmental Stewardship" of the State California Standard Specifications:

1. Provide continuous noise and dust abatement as required to prevent disturbance and nuisance to the public and workers and to the occupants of adjacent premises and surrounding areas. Dampen or cover areas affected by demolition operations as necessary to prevent dust nuisance.
2. When a certain level of noise is unavoidable because of the nature of the work or equipment involved, and such noise is objectionable to the occupants of adjacent premises, make arrangements with the jurisdictional authorities to perform such work or operate such equipment at the most appropriate time periods of the day.

D. Unknown Conditions:

1. The Contract Drawings and related documents may not represent all surface conditions at the site and adjoining areas. The known surface conditions are as indicated, and shall be compared with actual conditions before commencement of work.
2. Existing utilities and drainage systems below grade are located from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other such surface fixtures.
3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provided is not interrupted, and do not proceed with the work until written instructions are received from the Engineer.
4. Thickness of existing pavements are from previous construction documents, and do not imply the actual depth or thickness of the total pavement or base material, where it occurs. Remove pavement of whatever thickness as required.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. The Contractor shall furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required for performing the demolition and removal work.
- B. Materials used for backfill shall conform to the requirements for backfill of Section 31 00 00, Earthwork.

PART 3 - EXECUTION

3.01 PRESERVATION OF REFERENCE MARKERS

- A. Record the locations and designation of survey markers and monuments prior to their removal. Provide three reference points for each survey marker and monument removed, established by a licensed civil engineer or land surveyor currently registered in the State of California.
- B. Store removed markers and monuments during demolition work, and replace them upon completion of the work. Re-establish survey markers and monuments in conformance with the recorded reference points. Forward to the Engineer a letter verifying re-establishment of survey markers and monuments, signed by a licensed civil engineer or land surveyor currently registered in the State of California.

3.02 DEMOLITION

- A. Perform demolition in accordance with the approved Demolition Plan. Perform demolition work in accordance with ANSI A10.6 and the California Code of Regulations, Title 8 and Title 24, as applicable.
- B. Cap or plug sanitary sewer in accordance with the utility owner's standard details and instructions. Cap and plug pipe and other conduits abandoned due to demolition, with approved type caps and plugs as required by the utility owners.
- C. Backfill and compact depressions caused by excavations, demolition, and removal in accordance with applicable requirements of Section 31 00 00, Earthwork.

3.03 REMOVAL

- A. Remove existing pavements, structures, and site improvements that interfere with new construction, where demolition is not indicated. Coordinate as required with the work of Section 31 11 00, Clearing and Grubbing.
- B. Slabs may be broken for drainage and left in place where they are below grade and are not detrimental to the structural integrity of the fill or structure to be placed above, as determined by the Engineer.

3.04 OBLITERATE

- A. Obliterate existing pavement as described on plans in accordance with State of California, Department of Transportation (Caltrans), Standard Specifications, Section 15, Existing Highway Facilities.

3.05 SALVAGE

- A. Items or materials to be salvaged shall be as indicated on the Contract Drawings and in the Contract Specifications.

- B. Protect metallic coatings on salvaged items. Remove adhering concrete from salvaged items.
- C. Repair, or replace with new material, salvaged material damaged or destroyed due to Contractor's negligence, as determined by the Engineer.

3.06 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

- A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.
- B. Burying of trash and debris on the site will not be permitted. Burning of trash and debris at the site will not be permitted.
- C. Remove trash and debris from the site at frequent intervals so that their presence will not delay the progress of the work or cause hazardous conditions for workers and the public.
- D. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the District's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.07 CLEANUP

- A. Provide a clean and orderly site at all times in accordance with Section 4.1.02, "Final Cleaning Up" of Standard Specifications.

END OF SECTION 02 41 00

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SECTION 03 11 00
CONCRETE FORMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Layout of formwork.
- B. Formwork construction.
- C. Embedded items and openings in concrete.
- D. Form release materials.
- E. Removal of forms.
- F. Field quality control.
- G. Detection of movement.
- H. Re-use of forms.

1.02 RELATED SECTIONS

- A. Finishes for formed surfaces are specified in Section 03 35 00, Concrete Finishing.

1.03 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials
 - 2. ACI 301 Standard Specifications for Structural Concrete
 - 3. ACI 318 Building Code Requirements for Structural Concrete
 - 4. ACI 347 Formwork for Concrete
- B. American Plywood Association (APA):
 - 1. U.S. Product Standard PS 1 for Construction and Industrial Plywood
- C. Federal Specifications (FS):
 - 1. TT-S-230 Sealing Compound: Elastomeric Type, Single Component, (for Calking, Sealing, and Glazing in Buildings and Other Structures)
 - 2. TT-S-1543 Sealing Compound: Silicone Rubber Base (For Calking, Sealing, and Glazing in Buildings and Other Structures)
- D. West Coast Lumber Inspection Bureau (WCLB):

1. WCLB No. 17 Standard Grading Rules

1.04 QUALITY ASSURANCE

- A. Formwork Standards: Unless otherwise indicated, design, construct, erect, maintain, and remove forms and related structures for concrete work in accordance with applicable requirements of ACI 301, ACI 318, and ACI 347.
1. Architectural Concrete: Forms for architectural concrete shall be designed and constructed in accordance with ACI 301.
 2. Deflection: Where dead and live loads on forms will be more than 20 percent greater than the weight of the concrete, provide framing lumber of required strength, and comply with ACI 301 and ACI 347 for design of framing members. Deflection shall be kept within the herein specified tolerances.
 3. Concrete Mix Design: Design of formwork shall be coordinated with the concrete mix design, as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete, so that form materials, form surfaces, and formwork strength will produce the desired concrete tolerances and finishes.
- B. Formwork Surface Materials: Provide material and work quality which will produce clean and uniform finished surfaces within the allowable tolerances specified and which will conform with the following requirements:
1. Concrete Exposed to View: Provide material and work quality that will produce clean, smooth, and uniform concrete surfaces. Refer to Section 03 35 00, Concrete Finishing, and ACI 301 for requirements.
 2. Concrete Concealed from View: Provide material and work quality that will produce aligned concrete surfaces free of fins, honeycomb, and stains.
- C. Special Formwork Sections: Provide openings, offsets, sinkages, keyways, recesses, moldings, rustication strips, chamfers, blocking, screeds, bulkheads, anchorages, embedded items, and other features. Select materials and provide workmanship that will ensure indicated finishes.
- D. Chamfered Corners: All external corners shall be chamfered, unless otherwise indicated.
- E. Removal Features: Design formwork to be readily removable without impact, shock, and damage to concrete surfaces and adjacent materials.
- F. Tolerances for Formed Surfaces: For buildings and similar structures, comply with the requirements of ACI 301, as applicable. For those items of work or parts of the structure not covered by ACI 301, comply with the requirements of ACI 117, as applicable. Coordinate with the requirements specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete.

1.05 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Shop Drawings: Submit drawings that indicate and include the following details and requirements:
1. Forming system and method of erection with associated details.

2. Shoring accompanied by design calculations. Include reshoring procedures. Both drawings and calculations shall be signed by an engineer who is currently registered as a civil or structural engineer in the State of California.
 3. Locations of construction joints in plan and elevation views.
 4. Locations and sizes of conduits, openings, recesses, pipes, ducts, and other attached or embedded products.
 5. Beam intersections and other conditions where concrete casting by vertical drop may be restricted.
 6. Chamfer strips for corner treatment.
 7. Method and schedule for removing forms and shoring.
 8. Method for detecting formwork movement during concrete placement.
- C. Product Data: Submit manufacturers' product data for manufactured products.
- D. Samples: Submit form material, 12 inches by 12 inches or larger in size, for formed concrete which will be exposed in the finished work to public view. Such samples require approval of the Engineer before they may be used in the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Storage: Store form panels to prevent warpage. Protect panels from damage and contamination which could adversely affect concrete.
- B. Handling: Lift form panels by methods that will protect panels from damage and distortion.

1.07 JOB CONDITIONS

- A. Allow sufficient time between erection of forms and placing of concrete for the various trades to properly install concrete reinforcement, embedded items, sleeves, and blockouts.
- B. Do not apply superimposed loads to the structure until concrete has developed its specified 28-day compressive strength.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lumber: Boards and framing lumber shall be graded and grade-marked in accordance with WCLB No. 17. Provide framing lumber of required strength, conforming with the above-specified WCLB No. 17.
1. Boards: Provide all West Coast Species, "Construction" or "Standard" Boards. Use dressed side of lumber for surface in contact with the concrete, and provide boards with dressed or tongue-and-groove edges to provide tight joints to prevent mortar leakage.
 2. Framing Lumber:
 - a. Light Framing: Provide all West Coast Species, "Construction" or "Standard" Light Framing, dressed or rough. Where loads are not a factor, "Utility" Light Framing will be acceptable.

- b. Joists and Planks: Provide all West Coast Species, "No. 2" Structural Joists and Planks, dressed or rough.
 - c. Beams and Stringers: Provide all West Coast Species, "Standard" Beams and Stringers or "No. 2 Structural" Beams and Stringers, dressed or rough.
- B. Plywood (Plyform): Plywood shall be graded and grade-marked in accordance with U.S. Product Standard PS-1.
 - 1. B-B Plyform: Provide Class I, EXT-APA, sanded, APA trade marked.
 - 2. B-C Plyform: Provide Class I, EXT-APA, APA trade marked.
 - 3. High Density Overlay (HDO) Plyform: Provide A-A, 60-60, Class I, EXT-APA, APA trade marked.
 - 4. Thickness: As required to maintain surface smoothness without deflection, but not thinner than 5/8 inch.
- C. Steel Forms: Proprietary, patented, or fabricated steel forms, using standard or commercial quality, uncoated steel sheet or plate, 3/16-inch minimum thickness, for panel facings. Provide surfaces that will not impart corrosion residue to concrete. Include panel framing, reinforcement, and erection accessories.
- D. Waffle Slab Forms: Steel or reinforced plastic dome forms for two-way joist construction, smooth surface, of sizes indicated.
- E. Round Column Forms: Pressed or molded fiber-reinforced plastic or steel, manufactured round column forms, seamless or one-piece (one vertical seam), smooth surface, of sizes indicated.
 - 1. Provide forms with will not deflect under pressure of concrete placement, and which will not deflect or blow off under added pressure of placement of fly-ash-modified concrete.
- F. Formliners for Exposed and Architectural Concrete: Thermally formed, pressed or molded fiber-reinforced plastic (FRP), ABS alloy plastic, PVC alloy plastic, or similar material, manufactured to produce finished concrete of design, configuration, and surface texture indicated. Formliners shall be continuous, one piece. No horizontal joints shall be acceptable unless the applicable height exceeds the available formliner height. Provide formliners with inherent form-release surface. Formliners may be manufactured for single-use or multi-use service as appropriate.
- G. Leakage Control Materials: Provide materials capable of producing flush, watertight, and nonabsorbent surfaces and joints, and compatible with forming material and concrete ingredients. Seal form edges with gasketing material or sealant placed in the joint in such a way that neither a fin nor groove is made in the face of the cast concrete.
 - 1. Calking Compound: Silicone or polyurethane construction sealant conforming to FS TT-S-230 or TT-S-1543, as applicable.
 - 2. Tapes: Form film tape of polypropylene plastic treated with waterproof adhesive, for joint conditions not exposed to public view.
- H. Form Release Agent: Commercial formulation, silicone-free form-release agent, designed for use on all types of forms, which will not bond with, stain, nor adversely affect concrete surfaces, and which will not impair subsequent treatment of concrete surfaces requiring bond or adhesion nor impede wetting of surfaces which will be cured with water, steam, or curing compounds.

- I. Plugged Cone Form Ties: Rod type, with ends or end fasteners which can be removed without spalling the concrete and which leave a hole equal in depth to the required reinforcement clearance. Form ties shall be of a design in which the hole left by the removed end or end fastener is easily filled to match the surface of the hardened concrete. Provide removable cones 1-1/4 inches in diameter by 1-1/2 inches deep. Provide preformed mortar plugs to match the color of the concrete, recessed 1/4 inch, adhered with an approved epoxy adhesive.
- J. Inserts: Cast stainless steel or welded stainless steel, Type 316 or similar 300 Series, complete with anchors to concrete and fittings such as bolts, wedges, and straps. Provide hanger inserts spaced to match grid of suspended ceiling.
- K. Dovetail Anchor Slots: 22 gage or heavier galvanized steel dovetail anchor slots, for anchoring of masonry veneer with galvanized steel dovetail anchors provided under Division 4, Masonry.
- L. Chamfer Strips: 3/4 inch by 3/4 inch triangular fillets milled from clear, straight-grain pine, surfaced each side, or extruded vinyl type with or without nailing flange.
- M. Miscellaneous Joint Strips: Preformed strips for reveals, rustications, and similar joints fabricated of wood, metal, or plastic.

2.02 FABRICATION

- A. Formwork - General: Fabricate forms in accordance with approved Shop Drawings. Maintain forms clean, smooth, and free from imperfections and distortion. Fabricate forms for architectural concrete in accordance with applicable requirements of ACI 301.
- B. Joints:
 - 1. Arrange form panels in symmetrical patterns conforming to general lines of the structure.
 - 2. Unless otherwise indicated, orient panels on vertical surfaces with long dimension horizontal, and make horizontal joints level and continuous.
 - 3. Align form panels on each side of the panel joint with fasteners common to both panels, and in a manner which will result in a continuous, unbroken concrete plane surface.
- C. Steel Forms: Use material which is clean, smooth, and free from warps, bends, kinks, rust, cracks, and matter which may stain concrete. Fabricate panels in accordance with approved Shop Drawings. Deflection between form supports from concrete placement shall not exceed 1/240 of the span length.

PART 3 - EXECUTION

3.01 LAYOUT OF FORMWORK

- A. Locate and stake out all forms and establish all lines, levels, and elevations.

3.02 CONSTRUCTION

- A. Formwork:
 - 1. Construct formwork in accordance with the approved Shop Drawings, and in a manner that will produce finished concrete surfaces conforming to indicated design and within specified tolerances. Formwork for concrete not exposed to view in the finished work may be constructed of any material that will adequately support the weight of the concrete.

2. Make joints and seams mortar-tight. Install leakage control materials in accordance with the manufacturer's installation instructions, and in a manner that will maintain a smooth continuity of plane between abutting form panels and which will resist displacement by concreting operations.
 3. Kerf wood inserts for forming keyways, reglets, and recesses in a manner that will prevent swelling and ensure ease of removal.
 4. Maintain forms clean and free from indentations and warpage. Do not use rust-stained steel surfaces for forms in contact with concrete. Do not sandblast steel form surfaces to remove rust or mill scale; remove these imperfections by grinding.
 5. Brace temporary closures to prevent warpage or displacement and set tightly against forms in a manner that will prevent loss of concrete mortar.
 6. Support joints with extra studs or girts, and in a manner that will ensure true, square intersections.
 7. Assemble forms in a manner that will facilitate their removal without damage to the concrete.
 8. Construct molding shapes, recesses, and projections with smooth finish materials and install in forms with sealed joints.
 9. Provide camber in formwork as required to compensate for deflections caused by weight and pressures of fresh concrete and construction loads and as otherwise indicated. Provide camber strips to compensate for deflections due to permanent loads and long-term deflections due to shrinkage and creep as required.
 10. Provide construction openings in forms where required for concrete pour pockets, vibrator access holes, and inspection openings to aid in proper placement and consolidation of concrete, and close up openings during placement of concrete as applicable.
 11. Provide inspection and cleanout openings in forms at bottom of walls and columns and elsewhere as required. Do not close cleanouts until inspected and accepted by the Engineer just before placing concrete.
 12. Drill air escape holes in bottom members of blockouts.
 13. Ensure that formed stair risers within a stair run are equal.
- B. Edge Forms and Screeds for Slabs: Set edge forms or bulkheads and intermediate screeds for slabs to obtain required elevations and contours in the finished slab surface. Support screeds substantially without penetrating waterproof membranes and vapor barriers.
- C. Corner Treatment: Form chamfers with 3/4 inch on each leg, unless otherwise indicated, and accurately shape and surface in a manner which will produce uniformly straight lines and edge joints and which will prevent mortar runs. Extend terminal edges to limits, and miter chamfer strips at changes in direction.
- D. Construction Joints:
1. Locate joints as indicated. Support forms for joints in concrete so as to rigidly maintain their positions during placement, vibration, and curing of concrete. Install keys in all joints.

2. Locate and install construction joints, for which locations are not indicated, so as not to impair strength and appearance of the structure, and indicate such joints on Shop Drawings. Locations of construction joints require approval of the Engineer.
 3. Position joints perpendicular to longitudinal axis of pier, beam, or slab as the case may be.
 4. Locate joints in walls, vertically as indicated; at top of footing; at top of slabs on grade; at bottom of door openings; and at underside of the deepest beam or girder framing into wall; or as required to conform to indicated details.
 5. Provide keyways as indicated in construction joints in walls and slabs, and between walls and footings unless otherwise indicated. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
- E. Load Supports: Loads for construction of roof slab and suspended floor slabs shall be carried down to on-grade base slabs. These loads shall not be carried by intermediate slabs at any time. Formwork loads shall be carried only by structural elements that are supported directly by footings.

3.03 EMBEDDED ITEMS AND OPENINGS IN CONCRETE

- A. Install conduit, pipe sleeves, waterstops, appliance boxes, frames for items recessed in walls, door frames, drains, metal ties, inserts, nailing strips, blocking, grounds, and other fastening devices required for anchorage or attachment of other work. Firmly secure products in position, located accurately as indicated, before beginning concrete placement.
- B. Provide openings in concrete for passage of ducts, and provide clearances therefor as indicated on approved Shop Drawings.
- C. Where masonry walls will be tied to concrete construction in future construction, use dovetail anchor slots positioned for maximum flexibility for masonry installation.

3.04 FORM RELEASE MATERIAL

- A. Coat form contact surfaces with approved form release material before reinforcement is placed. Do not allow excess form release material to accumulate in the forms or to come into contact with surfaces that are required to be bonded to fresh concrete such as concrete reinforcement and embedded items. Apply form release material in compliance with manufacturer's application instructions.
- B. Coat steel forms with non-staining, rust-preventive form release material or otherwise protect against rusting.
- C. Apply form release material to bolts and rods that are to be removed or that are to be free to move.

3.05 REMOVAL OF FORMS

- A. Remove forms by methods which will not injure, mar, gouge, or chip concrete surfaces, overstress concrete members, or distort formwork. Use air pressure or other approved methods. Do not pry against concrete. Cut off nails flush. Leave surfaces clean and unblemished.

1. Where early form removal is not necessary and will not impact the Contractor's schedule, leave forms in place at least 72 hours, unless otherwise approved by the Engineer.
- B. When repair of surface defects or finishing is required at an early age, forms may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations and its own weight.
1. Concrete work that is damaged by removal operations shall be repaired as specified in Section 03 35 00, Concrete Finishing. Where exposed surfaces are damaged beyond acceptable repairing measures, the damaged concrete shall be removed and replaced with new concrete.
- C. Top forms on sloping surfaces of concrete may be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or treatment required on such sloping surfaces shall be performed at once and shall be followed by the specified curing.
- D. Wood forms for wall openings shall be loosened as soon as this can be accomplished without damage to the concrete.
- E. Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently so as not to be damaged by removal operations.
- F. Forms and shoring in the formwork used to support the weight of concrete in beams, suspended slabs, girders, and other structural members shall remain in place until the concrete has reached adequate strength and stiffness to support itself. Forms shall not be removed before the concrete has reached a minimum of 70 percent of the indicated design compressive strength, unless otherwise approved in writing by the Engineer.
- G. When shores and other vertical supports are so arranged that the non-load-carrying form-facing material may be removed without loosening or disturbing the shores and supports, the facing material may be removed at an earlier age provided the concrete surfaces are not damaged by such earlier removal.
- H. Plan reshoring operations in a manner that will ensure that areas of new construction will not be required to support their own weight. Reshoring shall be in place before shoring is removed. During reshoring, do not permit live loads on new construction. Do not locate reshores in a manner and location that will overstress members or induce tensile stresses where reinforcing bars have not been provided.
- I. When removal of formwork or reshoring is based on the concrete reaching a specified strength, the concrete shall be presumed to have reached this strength when test cylinders, field cured along with the concrete they represent, have reached the strength specified for removal of formwork or reshoring. Except for the field curing and age at test, the cylinders shall be molded and tested as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete.

3.06 FIELD QUALITY CONTROL

- A. Before placing concrete, check lines and grades of erected formwork and positioning of embedded inserts, blockouts, and joints for correctness. Verify that embedded piping and conduit are free from obstructions. Make corrections or adjustments to ensure proper size and location of concrete members and stability of forming systems.

- B. While placing concrete, provide quality control to assure that formwork and related supports have not been displaced, that loss of cement paste through joints is prevented, and that completed work will be within specified tolerances.
- C. During form removal, verify that architectural features meet the form and texture requirements of the samples approved by the Engineer.

3.07 DETECTION OF MOVEMENT

- A. Check movement using methods, such as plumb lines, tell tales, and survey equipment, to detect movement of formwork during concrete placement.

3.08 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Remove such material from the site. Apply form release coating as specified for new formwork.
- B. Align and secure joints in a manner that will preclude offsets. Do not use patched forms for exposed concrete surfaces.

END OF SECTION

SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Joint fillers.
- B. Joint sealing compound.
- C. Elastomeric joint seals.
- D. Plastic pads, spacers, and fillers.

1.02 RELATED SECTIONS

- A. Metal stair nosings, armor protection for concrete edges, metal anchors, inserts, sleeves, and various metal accessories related to cast-in-place concrete work are specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 75, Miscellaneous Metal.
- B. Calking and sealants related to the sealing of openings in walls and weatherproofing of station structures are specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 51, Concrete Structures.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C272 Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
 - 2. ASTM C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
 - 3. ASTM D994 Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
 - 4. ASTM D1190 Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
 - 5. ASTM D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
 - 6. ASTM D1622 Test Method for Apparent Density of Rigid Cellular Plastics
 - 7. ASTM D1751 Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 - 8. ASTM D2628 Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

9. ASTM D3405 Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements
 10. ASTM D3406 Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements
 11. ASTM D3542 Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges
 12. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
- B. State of California, Department of Transportation (Caltrans), Standard Specifications (2010)
1. Section 51-2.02 Sealed Joints

1.04 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Shop Drawings: Submit drawings showing locations of all joints to be filled and sealed.
- C. Product Data: Submit manufacturers' product data of joint fillers, sealing compounds, elastomeric joint seals, and plastic materials, verifying compliance with specified requirements.
- D. Samples: Submit 36-inch long sample of joint filler and elastomeric joint seals and one pint can of sealing compound.
- E. Certificates of Compliance: Submit certificates of compliance for sealed joints at bridge per Caltrans Standard Specifications, Section 51-2.02 Sealed Joints

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Joint Filler: Premolded, of sizes and thickness indicated, conforming to ASTM D994 or ASTM D1751, as applicable.
 1. For structural joints and joints subject to movement, provide elastomeric joint seals conforming to ASTM D2628 or ASTM D3542, as applicable.
- B. Joint Sealing Compound: Concrete joint sealant, conforming to ASTM D1190, ASTM D3405, or ASTM D3406, as applicable, for sealing of expansion (isolation) and contraction (control) joints in slabs and at junctions of slabs and vertical surfaces.

Color of joint sealant shall be as selected by the Engineer from manufacturer's standards.

 1. For asphalt pavements, provide ASTM D3405 sealant only. For concrete pavements and roadways, provide ASTM D3406 sealant only.
- C. Elastomeric Joint Seals: Preformed solid or multi-web design, virgin crystallization-resistant polychloroprene (neoprene) conforming with ASTM D2628 or ASTM D3542, as applicable. Seals shall be designed to function in a compressed installation mode.
 1. Lubricant Adhesive: ASTM D2628 or ASTM D3542, as applicable.

- D. Plastic Pads, Spacers, and Fillers: Extruded closed-cell polystyrene rigid board meeting requirements of ASTM C578, Type V, with the following physical properties:
1. Minimum weight and density when tested in accordance with ASTM D1622: 3.0 pounds per cubic foot.
 2. Minimum compressive strength when tested in accordance with ASTM D1621: 100 pounds per square inch.
 3. Maximum water absorption when tested in accordance with ASTM C272: 0.10 percent by volume.
 4. Maximum allowable flame spread when tested in accordance with ASTM E84: 10 flame-spread index (UBC Class I).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that joint surfaces are dry to the extent necessary for successful sealant application and long service life as recommended by the sealant manufacturer.
- B. Verify also that ambient and concrete-surface temperatures and humidity are within the ranges recommended by the manufacturer for successful sealant application.

3.02 PREPARATION

- A. Thoroughly clean joints free of dirt, debris, dust, and laitance.
- B. Prime joint surfaces, where required, as recommended by the manufacturer of the joint sealing compound or elastomeric joint seal, as applicable.
- C. Mix multi-component sealing compound as recommended by the manufacturer.

3.03 INSTALLATION

- A. Installation/Application Requirements: Joint fillers and sealing compounds shall be installed in accordance with the respective manufacturers' installation and application instructions. Comply also with ASTM D1190, ASTM D3405, Appendix XI., and ASTM D3406, Appendix XI., for application of sealants, as applicable. Coordinate the placement of joint fillers and securing them in position with the work of Section 03 11 00, Concrete Formwork.
- B. Expansion (Isolation) Joints:
1. Provide premolded joint filler to full depth of slabs, less 1/2 inch. Install joint filler with top edge 1/2 inch below the surface, and tool adjacent concrete edges to a 1/4-inch radius. Use steel pins to hold material in place during placing and floating of concrete. Finished joints shall be tight and leakproof.
 2. After a minimum of 28 days after slabs have been placed and finished, fill expansion joints with joint sealing compound to 1/8 inch below surface of slabs. No traffic shall be permitted to travel over sealed joints until sealing compound has properly cured.
- C. Contraction (Control) Joints: Saw-cut contraction joints and weakened plane joints shall be filled with joint sealing compound in areas and locations indicated. Joints shall be filled and tooled flush to within 1/16 inch of the slab surface.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Steel reinforcing bars.
- B. Galvanized reinforcing bars.
- C. Epoxy-coated reinforcing bars.
- D. Wire and spiral reinforcement.
- E. Welded steel wire fabric.
- F. Steel bar mats.
- G. Tie wire.

1.02 RELATED SECTIONS

- A. Reinforcement for masonry is specified in Section 04 22 00, Concrete Unit Masonry.
- B. Reinforcing steel for piles, drilled shaft foundations, portland cement concrete paving, concrete curbs, gutters, and walks, and utility structures is specified in their respective Sections.

1.03 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 Specifications for Structural Concrete for Buildings
 - 2. ACI 315 Details and Detailing of Concrete Reinforcement
 - 3. ACI 318 Building Code Requirements for Structural Concrete
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A82 Specification for Steel Wire, Plain, for Concrete Reinforcement
 - 2. ASTM A184/
A184M Specification for Fabricated Deformed Steel Bar Mats for
Concrete Reinforcement
 - 3. ASTM A185 Specification for Steel Welded Wire Fabric, Plain, for Concrete
Reinforcement
 - 4. ASTM A370 Test Methods and Definitions for Mechanical Testing of Steel Products
 - 5. ASTM A496 Specification for Steel Wire, Deformed, for Concrete Reinforcement
 - 6. ASTM A497 Specification for Steel Welded Wire Fabric, Deformed, for Concrete
Reinforcement

7. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 8. ASTM A706 Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement
 9. ASTM A767/
A767M Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
 10. ASTM A775/
A775M Specification for Epoxy-Coated Reinforcing Steel Bars
 11. ASTM A884/
A884M Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement
 12. ASTM D3963/
D3963M Specification for Epoxy-Coated Reinforcing Steel
 13. ASTM E8 Test Methods of Tension Testing of Metallic Materials
 14. ASTM E165 Test Method for Liquid Penetrant Examination
- C. American Welding Society (AWS):
1. AWS D1.4 Structural Welding Code - Reinforcing Steel
- D. Concrete Reinforcing Steel Institute (CRSI):
1. CRSI Manual of Standard Practice
 2. CRSI Publication, Placing Reinforcing Bars
- E. State of California, Department of Transportation (Caltrans), Standard Specifications (2010):
1. Section 52 Reinforcement

1.04 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Shop Drawings:
1. Submit bar lists, bending diagrams and schedules, and placement plans and details for all reinforcing steel. Bar lists shall include weights.
 2. Indicate descriptions, details, dimensions, arrangements and assemblies, and locations of reinforcing steel. Include number of pieces, sizes, and markings of reinforcing steel, laps and splices, supporting devices and accessories, and any other information required for fabrication and placement. Indicate any adjustments required as specified in Article 1.06.B.
 3. Check Contract Drawings for anchor bolt schedules and locations, anchors, hangers, inserts, conduits, sleeves, blockouts, and any other items to be cast in concrete for

possible interference with reinforcing steel. Indicate required clearances on Shop Drawings.

4. Detail reinforcing steel in accordance with requirements of the ACI 315. Indicate individual weight of each bar, total weight of each bar size, and total weight of all bars on the list. Base calculated weights upon nominal weights specified in ACI 318, Appendix on Steel Reinforcement Information.

C. Product Data:

1. Submit manufacturers' product data and installation instructions for proprietary manufactured materials and reinforcement accessories.
2. Submit manufacturers' product data and installation instructions for proprietary exothermic metal splicing systems and proprietary mechanical coupler splicing systems when such splicing methods are permitted.

D. Samples:

1. When galvanized or epoxy-coated reinforcing bars are indicated, furnish two 12-inch long samples and two additional samples bent to minimum radius of the rebar from each size and lot shipped to the jobsite.
2. Samples shall be representative of the materials furnished. These samples, as well as any additional random samples taken by the Engineer, may be tested for specification compliance.
3. Failure of any sample to meet specification requirements shall be cause for rejection of that lot.

E. Certificates:

1. For each lot or load of reinforcing steel delivered to the jobsite, furnish mill affidavits or test reports of compliance or similar certification, certifying the grades and physical and chemical properties of the reinforcing steel and conformance with applicable ASTM Specifications, including ASTM A370, Method A9.
2. For galvanized and epoxy-coated reinforcing bars, furnish certificates of compliance with ASTM A767/A767M for galvanized bars and with ASTM A775/A775M and D3963/D3963M for epoxy-coated bars.
3. For welders, furnish welding certificates or affidavits attesting to the welders' qualifications to perform the indicated welding in accordance with applicable requirements of AWS D1.4.
4. For exothermic sleeve coupler splicing, furnish certificates or affidavits attesting to the crew's special qualifications to perform the splicing.

1.05 QUALITY ASSURANCE

A. Tolerances:

1. Fabrication: Fabricate bars to meet the following tolerances:
 - a. Sheared length: plus or minus 1 inch.

- b. Depth of truss bars: plus 0, minus 1/2 inch.
 - c. Overall dimensions of stirrups, ties and spirals: plus or minus 1/2 inch.
 - d. All other bends: plus or minus 1 inch.
 - e. Fabrication tolerances not indicated on the Contract Drawings or specified above shall comply with the applicable requirements of ACI 301 and CRSI Manual of Standard Practice, Chapter 7.
2. Placement: Place bars to the following tolerances:
- a. Clear distance to formed surfaces: plus or minus 1/4 inch.
 - b. Minimum spacing between bars: minus 1/4 inch.
 - c. Top bars in slabs and beams:
 - 1) Member 8 inches deep or less: plus or minus 1/4 inch.
 - 2) Member greater than 8 inches, but less than 2 feet deep: plus or minus 1/2 inch.
 - 3) Members 2 feet or more deep: plus or minus 1 inch.
 - d. Crosswise of members: spaced evenly within 2 inches.
 - e. Lengthwise of members: plus or minus 2 inches.
 - f. Placement tolerances not indicated on the Contract Drawings or specified above shall comply with the requirements of ACI 301, ACI 318, or CRSI Manual of Standard Practice, as applicable.
- B. Adjustments: Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If bars are moved more than one bar diameter, or in excess of the above tolerances, the resulting arrangement of bars shall require the Engineer's approval. Minimum spacings shall not be decreased, and the required number of bars shall be placed. Bars moved to permit access for cleanup operations shall be properly replaced and secured before the start of concrete placement.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcing bars to the fabricator in bundles, limited to one size and length of bar, securely tied and identified with plastic tags in an exposed position indicating the mill, the melt or heat number, and the grade and size of bars.
- B. Deliver steel reinforcement to the jobsite, store, and cover in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, oil, or other cause which might impair bond with concrete.
- C. Deliver steel reinforcement to the jobsite properly tagged and identified, as specified herein in Article 2.03, in accordance with approved Shop Drawings.
- D. Handle and store galvanized and epoxy-coated reinforcement in a manner which will prevent damage to the coatings. For epoxy-coated reinforcement, comply with the requirements of ASTM D3963/D3963M.

- E. Maintain identification of steel reinforcement after bundles are broken.
- F. Provide special facilities for the storage and handling of exothermic materials as recommended by the splicing system manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel Reinforcing Bars:
 - 1. Billet-Steel Bars: ASTM A615, Grade 60, except that the maximum yield strength shall be 78,000 psi, and the tensile strength shall be not less than 1.25 times the actual yield strength. ASTM A615 bars may be welded only if the more stringent requirements of ANSI/AWS D1.4 are followed.
 - 2. Low-Alloy Steel Bars: ASTM A706. Provide ASTM A706 bars for bars to be welded.
 - 3. Weights of Bars: Refer to ACI 318, Appendix on Steel Reinforcement Information.
- B. Galvanized Reinforcing Bars: ASTM A706 or ASTM A615, as applicable, galvanized in accordance with ASTM A767/A767M, Class I coating. Bars shall be cut and bent cold before galvanizing.
- C. Epoxy-coated Reinforcing Bars: ASTM A706 or ASTM A615, as applicable, epoxy-coated in accordance with ASTM A775/A775M and ASTM D3963/D3963M. Coating material shall conform to ASTM A775/A775M and ASTM D3963/D3963M, Annex A1, green in color. Furnish acceptance test reports for each lot of epoxy-coated bars delivered to the site. Bars shall be cut and bent cold before applying coating material.
- D. Wire and Spiral Reinforcement: ASTM A82 for plain wire and ASTM A496 for deformed wire.
- E. Welded Steel Wire Fabric - Plain Wire: ASTM A185, wire sizes and center-to-center spacings as indicated.
- F. Welded Steel Wire Fabric - Deformed Wire: ASTM A497, wire sizes and center-to-center spacings as indicated.
- G. Welded Steel Wire Fabric - Epoxy-Coated: ASTM A884/A884M, wire sizes and center-to-center spacings as indicated.
- H. Steel Bar Mats - Deformed Bars: ASTM A184/A184M, using ASTM A706 deformed bars, sizes and spacings of members as indicated, welded or clipped at intersections.
- I. Accessories: Provide reinforcement accessories, consisting of bar supports, spacers, hangers, chairs, ties, and similar items as required for spacing, assembling, and supporting reinforcement in place. Conform with CRSI referenced standards and the following requirements:
 - 1. For footings, grade beams, and slabs on grade, provide supports with precast concrete or mortar bases or plates or horizontal runners where wetted base materials will not support chair legs.

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms or are in close proximity to finish surfaces, provide supports with legs which are galvanized, plastic-protected, or stainless steel.
 3. For galvanized reinforcement, provide all galvanized accessories.
 4. For epoxy-coated reinforcement, provide accessories which are nylon-, epoxy-, or plastic-coated.
- J. Tie Wire: No. 16 gage or heavier, black or galvanized, soft or commercial grade steel tie wire. For galvanized reinforcement, provide zinc-coated wire. For epoxy-coated reinforcement, provide nylon-, epoxy-, or plastic-coated wire. Where tie wire is in close proximity to finish surfaces of exposed-to-view concrete, provide soft stainless steel wire.
- K. Welding Electrodes: E90XX low hydrogen electrodes (for shielded metal arc welding.)
- L. Exothermic Metal-Filled Sleeve Coupler:
1. System Description: Provide bar splicing connection, produced by a standard exothermic process whereby molten filler metal, contained by a high-strength steel sleeve of larger inside diameter than adjoining bars, is introduced into the annular space between the bars and the sleeve as well as between the ends of the bars. Splicing system shall produce complete fusion with 100 percent penetration of the joint.
 2. Spliced Strength in Tension: 125 percent of the yield strength of connected reinforcing bars.
- M. Mechanical Splice Coupler:
1. System Description: Provide bar-splicing connections, produced by threaded reinforcing bar ends and threaded coupler, or by sleeves hydraulically pressed or forged onto butt-ended reinforcing bars, or by other proprietary mechanical splicing method as proposed by the Contractor and approved by the Engineer. Mechanical splice couplers shall be capable of being installed in the clear space indicated and to provide the required clearances.
 2. Spliced Strength in Tension: Minimum 125 percent of the yield strength of connected reinforcing bars, unless otherwise indicated.

2.02 FABRICATION

- A. Fabrication Standards: Fabrication of steel reinforcement shall be in accordance with the Contract Drawings and approved Shop Drawings. Where specific details are not indicated, comply with applicable requirements of ACI 301, ACI 318, and CRSI Manual of Standard Practice.
- B. Cutting and Bending: Cutting and bending shall be performed at a central location, equipped and suitable for the purpose. Bars shall be accurately cut and bent as indicated. Bars shall be bent cold. Heating of bars for bending or straightening will not be permitted. Bars shall not be bent or straightened in any manner which will injure the material. Label all bars in accordance with bending diagrams and schedules, and secure like pieces in bundles when appropriate.
- C. Welding:
1. Welding of reinforcement, where indicated and approved, including preparation of bars, shall conform with applicable requirements of AWS D1.4. Welders shall be prequalified in accordance with AWS D1.4, Chapter 6.

2. Use full penetration butt welds by the electric-arc method unless otherwise indicated or approved. Weld splices shall develop 125 percent of the specified yield strength of the bars, or of the smaller bar in transition splices.
 3. Clean bars of oil, grease, dirt, and other foreign matter and flame-dry before welding. Preheat bars before welding in accordance with AWS D1.4, Chapter 5. Stagger splices in adjacent bars a minimum of 48 inches.
- D. Repair of Damaged Coatings: Bars for galvanized reinforcement shall be cut and bent cold before galvanizing. Galvanized and epoxy coatings damaged by shipping, handling, or cutting and bending shall be repaired as specified in ACI 301, and ASTM A767/A767M, ASTM A775/A775M, ASTM A884/A884M, and ASTM D3963/D3963M, as applicable.

2.03 IDENTIFICATION

- A. Reinforcing steel shall be bundled and tagged with grades and sizes, heat numbers, and suitable identification marks for checking, sorting, and placing. Sizes and mark numbers shall correspond to placing Shop Drawings and schedules. Tags and markings shall be water-resistant and shall not be removed until steel reinforcement is placed in position.

2.04 REINFORCING STEEL FOR DUCT BANKS

- A. Reinforcing steel shall be provided for duct banks. Longitudinal steel shall be provided with a minimum total cross sectional area of 0.0018 times the gross area of the duct bank. The maximum spacing of reinforcing bars shall be 18 inches, with a minimum of one bar provided in each corner. Tie bars in the transverse direction enclosing the longitudinal steel bars shall also be provided, with a minimum size of No. 3 bars at a minimum spacing of 12 inches. The minimum clear concrete cover over reinforcing steel shall be 3 inches where concrete is cast directly against earth, and 1-1/2 inches where concrete is cast directly against fabricated formwork.
- B. Where duct banks enter rigid underground structures, reinforcing steel shall be provided to tie the duct bank to the structure. Details shall be provided showing methods used to prevent damage to duct banks due to differential settlement at these points.

PART 3 - EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that surfaces, over or against which concrete is to be placed, are clean and in proper condition for placing reinforcement.
- B. Verify that items to be embedded in concrete inserts, sleeves, and block-outs are secured in place as required.

3.02 PLACING

- A. Placing Standards: Reinforcing steel shall be placed in accordance with the Contract Drawings, approved Shop Drawings, and the applicable requirements of ACI 301, ACI 318, CRSI Manual of Standard Practice, and CRSI Placing Reinforcing Bars. Install reinforcement accurately and secure against movement, particularly under the weight of workers and the placement of concrete.
- B. Reinforcing Supports: Bars shall be supported on metal or plastic chairs, spacers, and hangers, accurately placed and securely fastened to steel reinforcement in place. Support legs

of accessories in forms without embedding in the form surface. Hoops and stirrups shall be accurately spaced and wired to the reinforcement.

- C. **Placing and Tying:** Reinforcing steel shall be installed in place, spaced, and rigidly and securely tied or wired with tie wire at all splices and at crossing points and intersections in the positions indicated. It is not necessary to tie bars at every intersection. Comply with requirements of CRSI Placing Reinforcing Bars, Chapter 10. Snap ties are acceptable for intermediate intersections. Rebending of bars on the job to fit different conditions will not be permitted. Point ends of wire ties away from adjacent form surfaces.
- D. **Spacing:** Center-to-center distance between parallel bars shall be in accordance with the Contract Drawings or, where not indicated, the minimum clear spacing shall be in accordance with ACI 318.
- E. **Longitudinal Location of Bends and Ends of Bar:** A maximum of plus or minus 3 inches from the indicated location will be permitted, provided that specified protective concrete cover at ends of members is not reduced by more than 1/2 inch.
- F. **Splices:**
1. **Lapped Splices:**
 - a. Laps of splices shall be securely tied together to maintain the alignment of the bars, to provide the required minimum clearances, and to transfer stress by bond. Lapped splices and development lengths not shown shall be detailed to develop Class B lapping lengths and development lengths in tension, respectively, in accordance with ACI 318.
 - b. Splices of alternate bars shall be staggered a minimum clear offset of 2 feet between splices. Splices shall be tied with tie wire, or splices may be lap welded in accordance with AWS D1.4. Lapped splices are not permitted for No. 14 and No. 18 bars, or when specifically excluded by Contract provisions regardless of size.
 2. **Exothermic Metal-Filled Coupler Splices:** Conform with the product manufacturer's installation instructions and recommendations and with applicable requirements of AWS D1.4 for exothermic welding.
 3. **Mechanical Coupler Splices:**
 - a. Perform installation of coupler and tightening of joint assembly in accordance with the coupler manufacturer's installation instructions and recommendations.
 - b. Reinforcing bars to be joined shall be shop threaded using special machinery to produce the required tapered threads. Where previously threaded bars must be cut or where threads are damaged, bars shall be replaced, or an alternate splicing system approved by the Engineer shall be substituted. Bars shall not be rethreaded, and damaged threads shall not be repaired in the field.
 - c. Prior to joining, inspect all threads and assure that they have been properly made and are clean.
 - d. Rotate coupler and bar initially by hand or wrench until snug (approximately 3-1/4 to 4 turns). Apply 24-inch minimum pipe wrench and turn coupler (or bar) until further turning is resisted with the application of a minimum torque of 200 foot-pounds. Suitably mark joint to indicate that tightening has been completed.

- e. For proprietary mechanical splicing systems not specified herein, installation shall conform with the manufacturer's installation instructions.
- 4. Spiral Reinforcement Splices: Splices shall conform with applicable requirements of ACI 318.
- G. Dowels: Provide dowels where indicated or required for connecting construction and for maintaining structural and reinforcement continuity. Dowels shall be tied securely in place before concrete is deposited. Provide additional bars for proper support and anchorage where required. Do not bend dowels after embedment.
- H. Welded Wire Fabric:
 - 1. Wire fabric shall be installed in lengths as long as practicable and shall be wire-tied at all laps and splices. End laps shall be offset in adjacent widths. Lap welded wire fabric in accordance with applicable requirements of ACI 318.
 - 2. Where required welded wire fabric shall be secured in position with suitable supports, accessories, and tie wire as indicated and required to ensure against movement from workers and placement of concrete lift fabric as concrete is placed to assure proper embedment at position indicated.

3.03 PROTECTIVE CONCRETE COVER

- A. Minimum concrete coverage for steel reinforcement shall be as specified in ACI 301, ACI 318, or CRSI Manual of Standard Practice. If there is a conflict between the standards specified, the thicker concrete coverage shall govern.

3.04 CLEANING:

- A. Reinforcement at time of depositing concrete shall be free of corrosion and coatings that may impair bond with concrete, such as form oil, mill scale, or loose deposits of rust and other corrosion.

3.05 FIELD QUALITY CONTROL

- A. In accordance with California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work quality control inspections and tests to be performed by the Contractor include the following:
 - 1. Placement of Reinforcing Steel: Visual inspection of reinforcing steel in place, including bar supports, tied laps and intersections, welded wire fabric, and bar mats.
 - 2. Welds:
 - a. Visual inspection of reinforcing bar welds.
 - b. Tension tests of welded butt joints. Tests shall be performed on sample welds produced by the Contractor in accordance with ASTM E8.
 - c. Nondestructive tests of installed welded butt joints shall be performed in accordance with ASTM E165.
 - d. Inspections and tests shall be performed in accordance with the applicable requirements of AWS D1.4, Chapters 6 and 7.
 - 3. Exothermic/Coupler Splices:

- a. Continuous visual inspection for the first eight hours, minimum, of the work as performed by any crew, and again by any replacement crew. All splices require visual inspection before concrete may be placed.
 - b. Visual inspection shall be performed in accordance with the product manufacturer's instructions and recommendations for such inspection.
 - c. Inspections shall measure and record all voids. Exothermic rebar splices shall be accepted, provided measured "void limits," per end, do not exceed manufacturer's specified "void limits."
 - d. Splices indicating improper fill, slag at tap hole, or blowouts shall be rejected.
4. Mechanical Coupler Splices: Test 100 percent of the couplers, using a 24-inch click-type torque wrench calibrated to 200 foot-pounds. Minimum turning torque of 200 foot-pounds shall be applied to the extent that further turning is resisted. Where tests reveal failure of couplers to be properly tightened, couplers shall be removed and replaced.
- B. For exothermic/coupler splices, the Contractor shall provide qualification splices for each position as follows:
1. One sister splice for the first 25 splices; thereafter, one sister splice for every 50 splices.
 2. Sister splices shall be laboratory tested by the Engineer for strength in tension (125 percent of the yield strength of connecting bars).

END OF SECTION 03 20 00

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conveying and placing concrete.
- B. Placement under water.
- C. Consolidation.
- D. Construction joints.
- E. Expansion and contraction joints.
- F. Curing and protection.

1.02 RELATED SECTIONS

- A. Portland cement concrete specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete.
- B. Finishing and curing of formed and unformed concrete surfaces, including repair and patching of surface defects, are specified in Section 03 35 00, Concrete Finishing.

1.03 DEFINITIONS

- A. The words and terms used in these Specifications conform to the definitions given in ACI 116R.

1.04 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 116R Cement and Concrete Terminology
 - 2. ACI 117 Standard Specification for Tolerances for Concrete Construction and Materials
 - 3. ACI 301 Standard Specifications for Structural Concrete
 - 4. ACI 302.1R Guide for Concrete Floor and Slab Construction
 - 5. ACI 303.1 Standard Specification for Cast-In-Place Architectural Concrete
 - 6. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
 - 7. ACI 304.2R Placing Concrete by Pumping Methods
 - 8. ACI 305R Hot Weather Concreting

9. ACI 306.1 Standard Specification for Cold Weather Concreting
 10. ACI 308 Standard Practice for Curing Concrete
 11. ACI 309R Guide for Consolidation of Concrete
 12. ACI 318 Building Code Requirements for Structural Concrete
 13. ACI 503.2 Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive
- B. American Society for Testing and Materials (ASTM):
1. ASTM C31 Standard Practice of Making and Curing Concrete Test Specimens in the Field
 2. ASTM C94 Specification for Ready-Mixed Concrete
 3. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
- C. California Department of Transportation (Caltrans), Standard Specifications (2010):
1. Section 51 Concrete Structures

1.05 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Shop Drawings:
1. Submit drawings that indicate the locations of all joints in concrete, including construction joints, expansion joints, isolation joints, and contraction joints. Coordinate with the requirements specified in Section 03 11 00, Concrete Forming.
 2. Submit drawings that indicate concrete placement schedule, method, sequence, location, and boundaries. Include each type and class of concrete, and quantity in cubic yards.
 3. Submit shop drawings for permanent steel deck forms in accordance with Caltrans Standard Specifications, Section 51-1.01C(2) Permanent Steel Deck Forms.
- C. Product Data: Submit manufacturer's product data for epoxy adhesive.
- D. Records and Reports: Report the location in the finished work of each mix design, and the start and completion times of placement of each batch of concrete placed for each date concrete is placed.

1.06 QUALITY ASSURANCE

- A. Tolerances:
1. Concrete Tolerances: Comply with the requirements of ACI 117 as applicable. Coordinate with the requirements specified in Section 03 11 00, Concrete Forming.
 2. Tolerances for Slabs and Flatwork: Comply with the requirements specified in Section 03 35 00, Concrete Finishing.

3. Tolerances for Roadway Surfaces of Structures and Approach Slabs: Comply with the requirements specified in Caltrans Standard Specifications, Section 51-1.01D(4)(b) Surface Smoothness.
- B. Coefficient of Friction for Deck Surfaces and Approach Slabs: Comply with the requirements specified in Caltrans Standard Specifications, Section 51-1.01D(4)(c) Coefficient of Friction.
- C. Crack Intensity for Deck Surfaces: Comply with the requirements specified in Caltrans Standard Specifications, Section 51-1.01D(4)(d) Crack Intensity.
- D. Architectural Concrete: Where concrete is indicated as architectural concrete exposed to public view, such concrete shall be produced in accordance with applicable requirements of ACI 301 and ACI 303.1.

Site Mock-Ups:

1. Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for mock-up requirements and procedures.
 2. Construct site mock-ups for all architectural concrete work and formed concrete that will be exposed to the public in the finished work, not less than 4 feet by 6 feet in surface area, for review and acceptance by the Engineer, before starting the placement of concrete.
 3. Approved site mock-ups shall set the standard for the various architectural concrete features, formed finishes, and colors of the concrete. Provide as many mock-ups as required to show all the different features and formed surfaces of the concrete.
- E. Cold Joints: Cold joints in concrete will not be permitted unless planned and treated properly as construction joints.
- F. Monitoring of Formwork: Provide monitoring of forms and embedded items to detect movement, or forms and embedded items out-of-alignment, from pressure of concrete placement.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Delivering and placing of concrete in hot weather and cold weather shall conform with applicable requirements of ACI 305R and ACI 306.1 and California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete.
- B. Do not place concrete when the rate of evaporation of surface moisture from concrete exceeds 0.2 pounds per square foot per hour as indicated in Figure 2.1.5 of ACI 305R.
- C. Do not place concrete in, or adjacent to, any structure where piles are required until all piles in the structure have been driven or installed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Formwork: Refer to Section 03 11 00, Concrete Forming, for requirements.
- B. Joint Fillers and Sealers: Refer to Section 03 15 00, Concrete Accessories, for requirements.

- C. Reinforcing Steel: Refer to Section 03 20 00, Concrete Reinforcing, for requirements.
- D. Concrete Curing Materials: Refer to Section 03 35 00, Concrete Finishing, for requirements.
- E. Epoxy Adhesive: ASTM C881, Type II for non-load-bearing concrete and Type V for load-bearing concrete, Grade and Class as determined by project conditions and requirements.
- F. Permanent Steel Deck Forms: Comply with the requirements specified in Caltrans Standard Specifications, Section 51-1.03C(2)(c) Permanent Steel Deck Forms.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect forms, earth bearing surfaces, reinforcement, and embedded items, and obtain the Engineer's written approval before placing concrete. Complete and sign a pour card on the form supplied by the Engineer. The Engineer shall countersign the card prior to commencing the pour.

3.02 PREPARATION

- A. Place concrete under the observation of the Engineer and with the Contractor's Quality Control Representative present to document requirements and results of the placement.
- B. Whenever possible, place concrete during normal working hours. When concrete- placement schedules require concrete placement at times other than normal working hours, ensure that the Engineer is notified and is present at the time of placement.
- C. Do not place concrete until conditions and facilities for the storage, handling, and transportation of concrete test specimens are in compliance with the requirements of ASTM C31 and Section 03 05 15, Portland Cement Concrete, and are approved by the Engineer.
- D. Prior to placement of concrete, the subgrade shall be in a firm, well-drained condition, and of adequate and uniform load-bearing nature to support construction personnel, construction materials, construction equipment, and steel reinforcing mats without tracking, rutting, heaving, or settlement. All weak, soft, saturated, or otherwise unsuitable material shall be removed and replaced with structural backfill or lean concrete.
- E. All structure foundations, including those for Stations and for subway box, shall be inspected and approved, in writing, by a qualified, independent geotechnical engineer prior to placement of footings and base slabs, to confirm the adequacy of the supporting soil for concrete placement.
- F. Earth bottoms or bearing surfaces for footings and slabs shall be dampened but not saturated or muddied just before placing concrete.

3.03 TRANSPORTING

- A. Concrete shall be central-mixed concrete from a central batch plant, transported to the jobsite in a truck mixer, in accordance with the requirements specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete, and ASTM C94.
- B. Transport concrete to the jobsite in a manner that will assure efficient delivery of concrete to the point of placement without adversely altering specified properties with regard to water-cement ratio, slump, air entrainment, and homogeneity.

3.04 CONVEYING AND PLACING

- A. Placement Standards: Conveying and placing of concrete shall conform with applicable requirements of ACI 301, ACI 302.1R, ACI 304R, and ACI 318.
- B. Handling and Depositing:
1. Concrete placing equipment shall have sufficient capacity to provide a placement rate that will preclude cold joints and that shall deposit the concrete without segregation or loss of ingredients.
 2. Concrete placement, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.
 3. Concrete shall be handled as rapidly as practicable from the mixer to the place of final deposit by methods that prevent the separation or loss of ingredients. Concrete shall be deposited, as nearly as practicable, in its final horizontal position to avoid redistribution or flowing.
 4. Concrete shall not be dropped freely where reinforcing will cause segregation, nor shall it be dropped freely more than 5 feet. Concrete shall be deposited to maintain a plastic surface approximately horizontal.
 5. In placing walls, columns, or thin sections (6 inches or less in thickness) of heights greater than 10 feet, concrete placement rate, lift thickness, and time intervals between lifts shall be as indicated on approved Shop Drawings. Openings in the form, elephant trunk tremies, or other approved devices, shall be used that will permit the concrete to be placed without segregation or accumulation of hardened concrete on the forms or metal reinforcement above the level of the fresh concrete.
 6. Concrete that has partially hardened shall not be deposited in the work. The discharge of concrete shall be started not later than 60 minutes after the introduction of mixing water. Placing of concrete shall be completed within 90 minutes after the first introduction of water into the mix.
- C. Pumping:
1. Concrete may be placed by pumping if the maximum slump can be maintained and if accepted in writing by the Engineer for the location proposed.
 2. Placing concrete by pumping methods shall conform with applicable requirements of ACI 304R and ACI 304.2R.
 3. Equipment for pumping shall be of such size and design as to ensure a continuous flow of concrete at the delivery end without separation of materials. Concrete from end of hose shall have a free fall of less than 5 feet. Pump hoses shall be supported on horses or similar devices so that reinforcement or post-tensioning ducts or tendons are not moved from their original position.
 4. The concrete mix shall be designed to the same requirements as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete, and may be altered for placement purposes with the prior approval of the Engineer.

3.05 PLACEMENT UNDER WATER

- A. Placement Standards: Placing of concrete in or under water shall conform with requirements of ACI 304R. All concrete to be placed under water shall be placed by the tremie method or by direct pumping.
- B. Placement Requirements: Deposit concrete in water only when indicated or approved in writing by the Engineer, and only under the observation of the Engineer. Use only tremie method and direct pumping with equipment that has been accepted by the Engineer.

3.06 CONSOLIDATION

- A. Concrete shall be thoroughly consolidated and compacted by mechanical vibration during placement in accordance with the requirements of ACI 309R.
- B. The Engineer will inspect concrete placement to confirm that proper placing methods are being employed, and that special techniques are being used in congested areas and around obstructions such as pipes and other embedded items. Check installation of embedded items for correct location and orientation during concrete placement.
- C. Conduct vibration in a systematic manner by competent, skilled, and experienced workers, with regularly maintained vibrators, and with sufficient back-up units at the jobsite. Use the largest and most powerful vibrator that can be effectively operated in the given work, with a minimum frequency of 8,000 vibrations or impulses per minute, and of sufficient amplitude to effectively consolidate the concrete.
- D. Insert and withdraw the vibrator vertically at uniform spacing over the entire area of the placement. Space the distance between insertions such that "spheres of influence" of each insertion overlap.
- E. Conduct vibration so as to produce concrete that is of uniform texture and appearance, free of honeycombing, air and rock pockets, streaking, cold joints, and visible lift lines.
- F. On vertical surfaces and on all architectural concrete where an as-cast finish is required, use additional vibration and spading as required to bring a full surface of mortar against the forms, so as to eliminate objectionable air voids, bug holes, and other surface defects. Additional procedures for vibrating concrete shall consist of the following:
 - 1. Reduce the distance between internal vibration insertions and increase the time for each insertion.
 - 2. Insert the vibrator as close to the face of the form as possible, without contacting the form.
 - 3. Use spading as a supplement to vibration at forms to provide fully filled out form surfaces without air holes and rock pockets.
 - 4. Provide vibration of forms only if approved by the Engineer for the location.

3.07 CONSTRUCTION JOINTS

- A. Construction joints will be permitted only where indicated or approved by the Engineer.
- B. Provide and prepare construction joints and install waterstops in accordance with the applicable requirements of ACI 301 and ACI 304R, and as specified in Section 03 11 00, Concrete Forming.

- C. Make construction joints straight and as inconspicuous as possible, and in exact vertical and horizontal alignment with the structure, as the case may be.
- D. Use approved key, at least 1-1/2 inches in depth, at joints unless otherwise indicated or approved by the Engineer.
- E. Thoroughly clean the surface of the concrete at construction joints and remove laitance, loose or defective concrete, coatings, sand, sealing compound and other foreign material. Prepare surfaces of joints by sandblasting or other approved methods to remove laitance and expose aggregate uniformly.
- F. Immediately before new concrete is placed, wet the joint surfaces and remove standing water. To allow for shrinkage, do not place new concrete against the hardened concrete side of a construction joint for a minimum of 72 hours.
- G. Locate joints that are not indicated so that the strength of the structure is not impaired. Joint types and their locations are subject to prior approval of the Engineer.
- H. Ensure that reinforcement is continuous across construction joints.
- I. Place waterstops in construction joints where indicated.
- J. Where bonding of the joint is required, provide epoxy adhesive hereinbefore specified and apply in accordance with ACI 503.2.
- K. Retighten forms and dampen concrete surfaces before concrete placing is continued.
- L. Allow at least 72 hours to elapse before continuing concrete placement at a construction joint. Approval for accelerating the minimum time elapsing between adjacent placements will be based on tests and methods that confirm that a minimum moisture loss at a relatively constant temperature will be maintained for the period as necessary to control the heat of hydration and hardening of concrete, and to prevent shrinkage and thermal cracking.

3.08 EXPANSION AND CONTRACTION JOINTS

- A. Refer to Section 03 11 00, Concrete Forming, for slab screeds and for formwork where expansion and contraction joints are indicated as architectural features, such as reveals or rustications.
- B. Refer to Section 03 15 00, Concrete Accessories, for expansion joint filler material and joint sealing compound.
- C. Refer to Section 03 35 00, Concrete Finishing, for finishing of edges of expansion joints in slabs with curved edging tool.

3.09 CURING AND PROTECTION

- A. Curing of concrete shall conform with applicable requirements of ACI 301 and ACI 308, except that the curing duration shall be a minimum period of ten days. HVFAC shall be cured a minimum of 28 days including an initial 10 days of moist curing. Curing with earth, sand, sawdust, straw, and hay will not be permitted.
- B. Keep concrete in a moist condition from the time it is placed until it has cured for at least ten days. Keep forms damp and cool until removal of forms.

- C. Immediately upon removal of forms, exposed concrete surfaces shall be kept moist by applying an approved curing compound or by covering with damp curing materials as specified in Section 03 35 00, Concrete Finishing.
- D. Concrete shall not be permitted to dry during the curing period because of finishing operations.
- E. Protect fresh concrete from hot sun, drying winds, rain, damage, or soiling. Fog spray freshly placed slabs after bleed water dissipates and after finishing operations commence. Allow no slabs to become dry at any time until finishing operations are complete.
- F. Finishing and curing of slabs are specified in Section 03 35 00, Concrete Finishing.
- G. Protect concrete from injurious action of the elements and defacement of any kind. Protect exposed concrete corners from traffic or use that will damage them in any way.
- H. Protect concrete during the curing period from mechanical and physical stresses that may be caused by heavy equipment movement, subjecting the concrete to load stress, load shock, or excessive vibration.

3.10 REPAIR OF SURFACE DEFECTS

- A. Refer to Section 03 35 00, Concrete Finishing, for requirements.

END OF SECTION 03 30 00

SECTION 03 35 00
CONCRETE FINISHING

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section includes specifications for the finishing and curing of exposed and unexposed, formed and unformed concrete surfaces, including the repair of surface defects.

1.02 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO):
1. M182 Burlap Cloth Made from Jute or Kenaf
- B. American Concrete Institute (ACI):
1. 117 Specification for Tolerances for Concrete Construction and Materials
 2. 301 Specifications for Structural Concrete
 3. 308 Standard Practice for Curing Concrete
 4. 503.4 Specification for Repairing Concrete with Epoxy Mortars
- C. ASTM International (ASTM):
1. C33 Specification for Concrete Aggregates
 2. C150 Specification for Portland Cement
 3. C171 Specifications for Sheet Materials for Curing Concrete
 4. C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 5. C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
- D. California Department of Transportation (Caltrans), Standard Specifications (2010):
1. Section 51 Concrete Structures

1.03 SYSTEM DESCRIPTION

- A. Finishing of formed concrete surfaces shall conform to applicable requirements of ACI 301.
- B. Finishes for slabs and flatwork shall conform to applicable requirements of ACI 301.
- C. Special architectural finishes for formed concrete surfaces shall conform to applicable requirements of ACI 301.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturers' product data for manufactured products.
- B. Samples: Review by the Engineer will be for color and texture only. Approved samples will become the Engineers control samples.
 - 1. Submit samples of not less than 12 inches by 12 inches in size of each type of architectural finish and color as described in the finish and color schedule in the Contract Drawings, indicating materials and methods used to produce the finishes.

1.05 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Comply with air pollution regulations of governing authorities for sandblasting activities and operations.
- B. Site Mock-Ups:
 - 1. Exposed Finishes: Construct site mock-ups for all exposed finishes including all architectural concrete work and all other formed concrete that will be exposed to the public in the finished work, of not less than 4 feet by 6 feet in surface area, for review and acceptance by the Engineer, before starting the placement of concrete.
 - 2. Approved site mock-ups shall set the standard for the various colors and finishes of all architectural concrete features and formed concrete work.
 - 3. Provide as many mock-ups as required to show all the different combinations of colors and finishes that are specified to obtain the Engineer s approval.
 - 4. Maintain approved mock-ups and use as the standard for the aesthetic quality of the surface finish for work represented by mock-ups. Remove mock-ups when permitted by the Engineer.

PART 2 - PRODUCTS

2.01 REPAIR AND FINISHING MATERIALS

- A. Portland Cement: ASTM C150, Type I or II, of same brand as used in the work. Furnish white Portland cement where required to produce color matching color of surrounding concrete.
- B. Aggregate:
 - 1. For Bonding Grout: ASTM C33, washed clean sand passing a No. 30 sieve.
 - 2. For Patching Mortar: ASTM C33 washed clean, graded fine aggregate of suitable size for areas to be repaired. Clean coarse aggregate up to Size No. 8 may be added for repair of larger pockets and voids.
 - 3. For Washed Aggregate Finish: Washed clean, match approved sample.

- C. Commercial Patching Mortar: A structural repair mortar may be furnished if appropriate for the use and approved by the Engineer.
- D. Epoxy Patching Mortar: As specified in ACI 503.4 for Epoxy Mortar.
- E. Epoxy Adhesive: ASTM C881, Type II or Type V, epoxy-based bonding agent.
- F. Color Hardener: As specified in the Contract Documents.

2.02 REPAIR MIXES

- A. Bonding Grout: 1 part Portland cement to 1 part No. 30 mesh sand, mixed to the consistency of a thick cream,
- B. Patching Mortar: Make the patching mortar of the same materials and of approximately the same proportions as used for the concrete, except omit the coarse aggregate. Use not more than 1 part Portland cement to 2-1/2 parts sand by damp loose volume, and substitute white Portland cement for a portion of the regular gray Portland cement to produce patching mix matching the surrounding concrete in color when dry. Determine the proportion of white Portland cement by trial mixes and test areas, prior to repair of actual defective areas.

2.03 CONCRETE COLOR

- A. Integral Color Concrete Pigment
 - 1. For concrete that includes integral color, provide ready-to-use, integral color material. Colors shall be as indicated on the Color and Finish Schedule in the Contract Drawings.

2.04 CURING MATERIALS

- A. Damp Curing Materials: Non-staining.
 - 1. Waterproof Sheet Materials: ASTM C171, waterproof paper with white paper face, polyethylene film pigmented white or white burlap- polyethylene sheeting.
 - 2. Burlap: AASHTO M182, of class or weight suitable for the use and location. Do not use burlap where concrete is exposed to direct sunlight.
- B. Curing Compound: ASTM C309, liquid membrane-forming curing compound, Type I, Class A or B, as appropriate for the use or location.
 - 1. Where concrete surfaces will receive architectural finishes, such as resilient floor coverings, paint, or membrane waterproofing, membrane- forming curing compound shall not leave a coating or residue which will impair bond of adhesives, paints, and coatings with concrete.
- C. Curing Compound for Colored Concrete: Curing compound shall be approved by the color additive manufacturer for use with colored concrete. Provide W-1000 Clear Cure & Seal, manufactured by Davis Colors, or approved equal.

PART 3 - INSTALLATION

3.01 FINISH OF FORMED SURFACES

- A. Unexposed Surfaces:
1. Concrete which will not be exposed shall be exposed in the completed structure shall be any form finish as specified in Section 03 11 00, Concrete Forming, and ACI 301 for rough form finish.
 2. Concrete to receive membrane waterproofing shall receive a "smooth form finish" in accordance with ACI 301.
- B. Exposed Surfaces: Concrete which will be exposed shall receive the finishes and colors as described in the Contract Drawings.
1. Construction Joints: Use technique acceptable to the Engineer to achieve uniform treatment of construction joints.
 2. Protection and Repair:
 - a. Protect adjacent materials and finishes from dust, dirt, and other surface or physical damage during abrasive blast finishing operations. Provide protection as required and remove from site at completion of the work.
 - b. Repair or replace other work damaged by finishing operations.
 3. Clean-up: Maintain control of concrete chips, dust, and debris in each area of the work. Clean up and remove such material at the completion of each day of operation. Prevent migration of airborne materials by the use of tarpaulins, wind breaks, and similar containing devices.

3.02 REPAIR OF SURFACE DEFECTS

- A. Repair Standards: Repair of surface defects shall conform to applicable requirements of ACI 301. When using epoxy mortar, conform to applicable requirements of ACI 503.4.
- B. Surface Defects:
1. Begin repair of surface defects immediately after form removal. For repair with epoxy mortar, concrete shall be dry.
 2. Surface defects are defined to include: form-tie holes, air voids and pockets, bug holes with a nominal diameter or depth greater than 1/4- inch, honeycombed areas, rock pockets, visible construction joints, fins and burrs.
 3. Repair of surface defects shall be tightly bonded and shall result in concrete surfaces of uniform color and texture, matching adjacent surfaces, and free of shrinkage cracks.
- C. Repair Work:
1. Remove honeycombed and other defective concrete down to sound concrete. Saw-cut the edges perpendicular to the surface or slightly undercut. Feather-edges will not be permitted. Dampen the area to be patched and an area at least 6 inches wide surrounding it to prevent absorption of water from the patching mortar.

2. Where rock pockets or similar defects or voids expose steel reinforcement, cutout to solid surface behind the reinforcing steel to provide suitable key-lock for patching mortar. Envelop exposed reinforcing bar with patching mortar.
3. Bond patching mortar to concrete with bonding grout or epoxy adhesive. Brush bonding grout well onto the concrete. Bond commercial patching mortar to concrete in accordance with the manufacturer s instructions.
4. After surface water has evaporated from the area to be patched, brush the bond coat well into the surface. When the bond coat begins to lose the water sheen, apply the patching mortar. Compact the mortar into place and strike off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, leave the patch undisturbed for at least 1 hour before being finally finished. Keep the patched area damp for 7 days.
5. Neatly finish patched surfaces to match adjacent surrounding surface texture of concrete. Grind or fill surfaces to produce level and plumb, true planes.
6. For walls exposed in the finish work, form tie holes shall be patched and finished flush with adjacent surface. For holes passing entirely through walls, use a plunger type injection gun or other suitable device to completely fill the holes.
7. In order to patch honeycombed areas or rock pockets which are too large and unsatisfactory for mortar patching, cut out to solid surface, key, and pack sold with matching concrete to produce firm bond and flush surface. Patching shall match texture of adjacent surfaces where exposed in the finished work.
8. Remove repair work in exposed locations which does not match the texture and color of surrounding adjacent surfaces or which was not well performed and perform again until the repair work conforms to specified requirements.
9. Remove fines and loose materials from surfaces to receive membrane waterproofing, and patch voids and cracks flush with adjacent surfaces.
10. Cure completed repairs as specified in Article 3.05, Curing, herein.

3.03 SLABS AND FLATWORK

- A. Placement and Finishing Standards: Place, consolidate, and finish slabs and flatwork in accordance with applicable requirements of ACI 301. Coordinate with Section 03 30 00, Cast-In-Place Concrete, as applicable.
- B. Placement :
 1. Place slabs and flatwork and finish monolithically. Strike off and screed slabs to true, plane surfaces at required elevations, and thoroughly compact concrete with vibrators, floats, and tampers to force coarse aggregate below the surface. Finish slab within four hours of concrete placement.
 2. Whether indicated or not, in areas where drains occur, slope finished slab to drains. Slope shall be a minimum of 1/8-inch per foot unless otherwise indicated.
- C. Slab finishes: Unless indicated otherwise, slabs and flatwork shall receive the following finishes as indicated:

1. Scratched finish: Conform to ACI 301. Provide "scratched finish" for slab substrates to receive cementitious toppings or finishes, such as terrazzo or mortar setting bed for ceramic tile.
2. Floated finish: Conform to ACI 301. Provide "floated finish" for track slabs and mud slabs and for slabs and flatwork to receive roofing and membrane waterproofing.
3. Troweled finish: Conform to ACI 301. Provide "troweled finish" for interior slabs and flatwork to be exposed in the completed structure, for slabs to receive resilient floor coverings, and for flatwork to receive elastomeric bearing pads.
4. Broom finish: Conform to ACI 301. Exact texture and coarseness of the broom finish shall match the approved site mock-up. Provide fine or medium-coarse "broom finish" as indicated for exterior sidewalks and paving, garage floors (other than parking garages), exterior ramps, equipment and transformer pads, and subway invert slab.
5. Unspecified finish: When finish is not indicated or specified, provide finishes as specified in ACI 301.
6. Washed aggregate finish: Evenly distribute seeded aggregate over a floated finish. Tamp surface to bring fines to surface completely covering seeded aggregate. Apply troweled finish. Apply surface retarder according to manufacturer's instructions and recommendations. Wash surfaces with water and finish with stiff bristle brush until seeded aggregate is uniformly exposed.
7. Swirl Pattern Finish: After basic floating operations have been completed, hand float slabs using wood float to produce a continuous swirl patterned surface, free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface. Use natural arm circular motion to produce rows of approximately 1-foot radius swirl pattern covering approximately half of the preceding row with each successive row. Provide swirl pattern finish for parking garage floors.

D. Surface Tolerances and Finishes: Refer to Article 3.04, Tolerances, herein.

1. Flat Tolerance: Slabs and flatwork with "troweled finish" and with "nonslip finish."
2. Straightedge Tolerance: Slabs and flatwork with fine "broom finish" or medium-coarse "broom finish."
3. Bullfloated Tolerance: Slabs and flatwork with "scratched finish," with "floated finish," and with coarse "broom finish."

E. Joints:

1. Construction, expansion, isolation, and contraction joints shall be located as indicated. Construction joints shall act as contraction joints. Where additional contraction joints are required to prevent shrinkage cracks, saw-cut such joints. All joints shall be straight and true to line.
2. Mark-off lines or edges at formed construction and expansion joints shall be finished with 1/4-inch radius curved edging tool, neat and true to line, uniform throughout.

3.04 TOLERANCES

A. Formed Surfaces: Conform with applicable requirements of ACI 117.

1. Where elastomeric bearing pads are indicated, the level plane upon which bearing pads are placed shall not vary more than 1/16-inch from a 10-foot straightedge placed in any direction across the area and the area shall extend a minimum of 1 inch beyond the limits of the pads.
 2. Bearing surfaces of girders on a slope or girders with a camber shall be finished on a horizontal/level plane so that loads are uniformly distributed over the entire surface of the elastomeric bearing pads.
 3. The finished plane shall not vary more than 1/8-inch from the elevation indicated.
- B. Slabs and Flatwork: Conform to applicable classification requirements of ACI 117, as follows:
1. Very Flat Tolerance: True plane with maximum variation of 1/8-inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.
 2. Flat Tolerance: True plane with maximum variation of 3/16-inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.
 3. Straightedge Tolerance: True plane with maximum variation of 5/16-inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.
 4. Bullfloated Tolerance: True plane with maximum variation of 1/2-inch in 10 feet when measured with a 10-foot straightedge placed anywhere on the slab in any direction.

3.05 Curing

- A. Curing Standards: Cure concrete in accordance with applicable requirements of ACI 301 and ACI 308, except that the duration of the curing period shall be ten days. Curing of concrete shall also conform to Section 03 30 00, Cast-In-Place Concrete.
- B. Curing Requirements:
1. Cure concrete with waterproof sheet materials, damp burlap, or curing compounds.
 2. Do not use curing compounds on surfaces when their use may be detrimental to bonding of concrete, mortar, membrane waterproofing, calking and sealants, adhesives, plaster, paint, or the specified surface finish or coating.
 3. Cure color-hardener finished slabs and flatwork as recommended by the color-hardener material manufacturer.
 4. Cure integrally colored concrete as specified herein.
 5. At the expiration of the curing period, clean concrete surfaces of all curing media.
- C. Damp Curing:
1. Vertical surfaces shall be cured by keeping the forms wet at all times and by leaving the forms in place as long as possible as specified in Section 03 11 00, Concrete Forming. After removal of forms, concrete shall be kept continuously damp by fog spraying or otherwise washing down the concrete in an accepted manner until ten days after placing. Protect exposed surfaces by covering with sheet materials or burlap kept continuously moist.

2. Horizontal surfaces shall be cured and protected by covering the finished surfaces with waterproof sheet materials or damp burlap, left in place for a minimum of ten days and kept continuously moist.
 3. Fog spray freshly placed slabs until finishing operations commence. Allow no slabs to become dry until finishing operations are complete.
- D. Curing Compound: Non-structural concrete, such as slabs-on-grade, may be cured by membrane curing compound in lieu of wet curing specified above. Apply curing compound in accordance with applicable requirements of ACI 308 and manufacturer's instructions. Apply without delay on newly finished surface. Protect integrity of membrane and touch up damaged spots immediately.

3.06 Protection

- A. Protect exposed concrete surfaces, including flatwork, as required to prevent damage from impact or strains.
- B. Protect fresh concrete from drying winds, rain, damage, or soiling.
- C. Refer to Section 03 30 00, Cast-In-Place Concrete, for additional requirements.
- D. Prevent contamination of planting areas during washing of washed aggregate finish.

END OF SECTION

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Specimens from Hydraulic-Cement Grout

- g. ASTM C1107 Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrinkable)
- 3. U. S. Army Corps of Engineers, Concrete Research Division (CRD):
 - a. CRD-C620 Standard Method of Sampling Fresh Grout
 - b. CRD-C621 Non-shrink Grout

1.05 SUBMITTALS

- 1. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- 2. Product Data: Submit manufacturer's product data and installation instructions.
- 3. Certification: Submit certificates of compliance or laboratory test reports which indicate the following:
 - a. Materials used in the grout are free from metallic components and corrosion-producing elements.
 - b. Materials meet specified shrinkage and compressive strength requirements.

1.06 ENVIRONMENTAL REQUIREMENTS

Handle grout the same as concrete with regard to temperature and curing, as specified in Section 03 30 00, Cast-In-Place Concrete, and Section 03 35 00, Concrete Finishing.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cementitious Grout: Provide non-shrink, non-metallic, non-corrosive cement-based grout conforming to the following requirements:
 - 1. Applicable Standards: ASTM C1107 and CRD-C621.
 - 2. Grout shall be manufactured specifically for use in supporting heavy loads (loads in excess of 300 pounds per square foot concentrated load or 100 pounds per square foot uniform load). Grout: ASTM C1107, Grade A, B, or C, as appropriate for the condition or circumstance.
 - 3. Shrinkage at 28 days: No shrinkage before hardening (0.00 shrinkage when tested in accordance with ASTM C827); no shrinkage after hardening (0.00 shrinkage when tested in accordance with CRD-C621).
 - 4. Compressive strength, minimum:
 - a. At one day: 1000 psi
 - b. At three days: 2500 psi
 - c. At seven days: 3500 psi
 - d. At 28 days: 5000 psi

5. Initial setting time, after addition of water: approximately one hour at 70 degrees F.
 6. Provide nonsag trowelability or flowability as necessary for the particular application.
- B. Water: Clean and potable, free of impurities detrimental to grout.
- C. Epoxy Grout: Provide non-shrink, non-metallic, non-corrosive epoxy grout conforming to the following requirements:
1. Grout shall be manufactured specifically for use in supporting heavy loads.
 2. Shrinkage at 28 days: None (0.00 shrinkage when tested in accordance with ASTM C827 modified procedure) with a minimum effective bearing area (EBA) of 95 percent coverage of the tested base plate.
 3. Compressive strength, minimum: 10,000 psi at seven days, when tested in accordance with ASTM C579.
 4. Initial setting time: Approximately one hour at 70 degrees F.
 5. Provide flowable consistency as necessary for the particular application.
 6. Epoxy grouts which are volatile and which give off noxious fumes are not acceptable.
- D. Epoxy Adhesive: ASTM C881, Type V, epoxy-based bonding agent.

2.02 MIXING

- A. Mix grout ingredients for both cementitious grout and epoxy grout in accordance with the respective manufacturer's mixing instructions and recommendations. Mix grout materials in proper mechanical mixers.
- B. Mix grout as close to work area as possible.

2.03 SOURCE QUALITY CONTROL

- A. Inspections and Tests: Perform visual inspections and shrinkage tests using an appropriate independent testing laboratory, and strength tests as necessary to verify performance requirements of grout. Sampling and testing of grout shall conform with applicable ASTM or CRD-C620 requirements.
- B. Visual Inspections: Perform visual inspection of the grout mixing and placement to determine and verify that grout consistency, slump, and stiffness are appropriate and proper for the location and type of installation.
- C. Shrinkage Tests:
1. Cementitious Grout: Grout shall meet the following performance requirements:
 - a. Expansion: 0.4 percent maximum at 3, 14, and 28 days. Grout shall exhibit no displacement when tested in accordance with ASTM C157.
 - b. Shrinkage: None (0.00 shrinkage at 28 days when tested in accordance with ASTM

C827 and ASTM C1090). There shall be no vertical volume shrinkage of grout in the plastic or hardened stage at any time.

2. Epoxy Grout: Grout shall meet the following performance requirements:
 - a. Expansion: Grout shall exhibit no displacement when tested in accordance with ASTM C827 and ASTM C157, modified procedures.
 - b. Shrinkage: None (0.00 shrinkage when tested in accordance with ASTM C827, modified procedure; specific gravity of indicator ball will be changed to approximately 1.0).
 - c. Effective Bearing Area: 95 percent minimum coverage of the tested base plate.
- D. Strength Tests: Compressive strength of grout shall meet the following requirements:
 1. Cementitious Grout: 5,000 psi minimum at 28 days when tested in accordance with ASTM C109.
 2. Epoxy Grout: 10,000 psi minimum at 7 days when tested in accordance with ASTM C579.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Concrete surfaces to receive grout shall be prepared by chipping, sandblasting, water blasting, or other accepted methods to remove defective concrete, laitance, dirt, oil, grease, and other foreign matter to achieve sound, clean concrete surfaces. Lightly roughen concrete for bond, but not enough to interfere with proper placement of grout.
- B. Cover concrete areas with protective waterproof covering until ready to place grout.
- C. Remove foreign matter from steel surfaces to be in contact with grout. Clean contact steel surfaces as necessary by wire brushing and wiping dust clean.
- D. Align and level components to be grouted, and maintain in final position until grout placement is complete and accepted.
- E. Install forms for grout around the column base plates and other spaces to be grouted. The tops of such forms shall be one inch above the surfaces to be grouted.
- F. Remove protective waterproof covering and clean contaminated surfaces immediately before grouting.
- G. Provide air-relief holes in large baseplates and in baseplates where underneath obstructions may cause air entrapment.
- H. Saturate concrete surfaces with clean water, and remove excess water immediately before grouting.
- I. Where necessary or appropriate for better bond, epoxy adhesive may be applied to clean, dry substrate surfaces in accordance with applicable requirements of ACI 503.2.

3.02 PLACING GROUT

- A. Place grout in accordance with the respective manufacturer's installation instructions and

recommendations. Pour grout from one side only until grout rises at least one inch above the plate on opposite side of said plate. Strapping and plunging or other recommended method may be used to force grout to flow under the entire area.

- B. Neatly trowel edges of grout base, tapered at an angle of 60 degrees when measured from the horizontal, or as indicated. Provide dry-pack cementitious grout where additional grout is required for shoulders.
- C. Do not remove leveling shims for at least 48 hours after grout has been placed.
- D. After shims have been removed, if used, fill voids with grout, packing the material with a suitable tool.
- E. Do not use grout which has begun to set or if more than one hour has elapsed after initial mixing.

3.03 CURING

- A. Cementitious grout shall be cured the same as specified for concrete in Section 03 35 00, Concrete Finishing.
- B. Epoxy grout shall be cured as recommended by the grout manufacturer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

Grout work will not be measured separately for payment.

4.02 PAYMENT

Grout work will be paid for as part of the indicated Contract price for the work or structure in which the grout is used.

END OF SECTION 03 61 11

SECTION 042200
CONCRETE MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Concrete Masonry Units
 2. Epoxy Bonding Adhesive
 3. Control Joint Materials
 4. Joint Reinforcement
 5. Reinforcing Steel
 6. Precast Beams, Lintels and Copings
 7. Mortar
 8. Grout
 9. Surface Sealer

1.2 REFERENCES

- A. American Concrete Institute (ACI):
1. ACI 530 Building Code Requirements for Masonry Structures
 2. ACI 530.1 Specifications for Masonry Structures
- B. American Society for Testing and Materials (ASTM):
1. ASTM C33 Specification for Concrete Aggregates
 2. ASTM C90 Specification for Hollow Load-Bearing Concrete Masonry Units
 3. ASTM C91 Specification for Masonry Cement
 4. ASTM C94 Specification for Ready-Mixed Concrete
 5. ASTM C109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
 6. ASTM C143 Test Method for Slump of Hydraulic Cement Concrete
 7. ASTM C144 Specification for Aggregate for Masonry Mortar
 8. ASTM C150 Specification for Portland Cement
 9. ASTM C207 Specification for Hydrated Lime for Masonry Purposes
 10. ASTM C270 Specification for Mortar for Unit Masonry
 11. ASTM C404 Specification for Aggregates for Masonry Grout
 12. ASTM C476 Specification for Grout Masonry
 13. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 14. ASTM C979 Specification for Pigments for Integrally Colored Concrete
 15. ASTM C1006 Test Method for Splitting Tensile Strength of Masonry Units
 16. ASTM C1019 Test Method for Sampling and Testing Grout
- C. State of California, Department of Transportation, 2006 Standard Specifications and Amendments, (Caltrans):
1. Section 52 Reinforcement
 2. Section 90 Portland Cement Concrete

1.3 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:
California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 21, "Masonry," and Chapter 21A, "Masonry."

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data for block, including available color range, epoxy adhesive, joint reinforcement, and control-joint materials, along with installation instructions where applicable.

- B. Working Drawings:
 - 1. Submit detailed working drawings of unit masonry, showing type of mortar joints, bond pattern, reinforcing steel, connecting dowels, joint reinforcement, grouted cells, and control joints.
 - 2. Submit calculations and working drawings for temporary supports of masonry lintels. Design and construct temporary supports to provide the necessary rigidity and to support loads which will be applied. Design calculations and working drawings must be stamped and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California. The expiration date of the registration must be shown.
- C. Samples: Submit full-size samples of block and samples of colored mortar for approval. Block and colored joint mortar require approval of the Engineer before they may be used in the concrete masonry work.
- D. Grout Mix Design: Submit a grout mix design for each grout mix proposed for use. Submit a revised grout mix design for any proposed change to the proportions of an approved grout mix.
- E. Qualification Data: Submit qualification data for proposed testing laboratory.
- F. Certificates: Submit certification stating that concrete masonry units meet specification requirements and that masonry units conform with the special strength requirements of these Specifications. Each certificate shall be signed by the masonry unit manufacturer and shall contain the name of the manufacturer, the project location, and the quantity and dates of shipment or delivery to which the certificate applies.
- G. Field Quality Control Plan:
 - 1. Submit a written Field Quality Control Plan that identifies the inspector, the testing laboratory, and the procedures to be used. The plan must conform to these specifications and the CBC.
 - 2. Designate a Masonry Quality Control Manager (MQCM) in the Field Quality Control Plan. The MQCM must be directly responsible to the Contractor for the quality of masonry, including materials and workmanship, performed by the Contractor and subcontractors.
 - 3. The MQCM must be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.
 - 4. The MQCM must be the sole individual responsible to the Contractor for submitting, receiving, and approving all correspondence, required submittals, and reports to and from the Engineer.

1.5 QUALITY ASSURANCE

- A. Concrete unit masonry work shall conform with applicable requirements of the California Building Code, Chapters 21 and 21A, ACI 530, and ACI 530.1, except as modified in these Specifications.
- B. Construction tolerances for concrete unit masonry shall conform with ACI 530.1.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to the project in an undamaged condition.
- B. Store CMUs on elevated platforms in a dry location. If CMUs are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If CMUs become wet, do not install until they are dry.
- C. Store cementitious materials on elevated platforms and in a dry location. Do not use cementitious materials that have become damp.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
- F. Prevent damage, contamination, corrosion, or other deterioration to masonry materials when handling.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: Cover partially completed masonry, tops of walls, projections, and sills with waterproof sheeting when construction is not in progress.
- B. Stain Prevention:
 - 1. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 2. Protect the base of walls from rain-splashed mud and from mortar splatter by spreading coverings on the ground and over wall surfaces.
 - 3. Protect sills, ledges, and projections from mortar droppings. Protect surfaces of door frames, and other similar products with painted and integral finishes, from mortar droppings.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete Masonry Units (Concrete Block):
 - 1. Concrete masonry units shall be of modular face dimensions and thicknesses indicated. Furnish necessary shapes and sizes, bond-beam units, and corner units as required to satisfy conditions indicated. Include half-size units where indicated or required. Units shall be closed-end.
 - 2. Concrete masonry units shall be hollow load-bearing units conforming to ASTM C90, and shall be No. 1 Normal Weight, Type I - Moisture Controlled Units, minimum Grade N. Units shall have a maximum linear shrinkage of 0.06 percent, and shall meet water absorption requirements of ASTM C90.
 - 3. Concrete masonry units shall be normal cement-colored units with standard face surfaces.
- B. Burnished Block (Ground-face) Concrete Masonry Units:
 - 1. Face: Smooth ground textured, exposed aggregate honed appearance.
 - 2. Concrete masonry units shall be normal cement-colored units.
 - 3. Concrete masonry units shall be of modular face dimensions and thicknesses indicated. Furnish necessary shapes and sizes, bond-beam units, and corner units as required to satisfy conditions indicated. Include half-size units where indicated or required. Units shall be closed-end.
 - 4. Concrete masonry units shall be hollow load-bearing units conforming to ASTM C90, and shall be No. 1 Normal Weight, Type I - Moisture Controlled Units, minimum Grade N. Units shall have a maximum linear shrinkage of 0.06 percent, and shall meet water absorption requirements of ASTM C90.
- C. Mortar Cement: ASTM C150, Type II Portland cement, low alkali.
- D. Grout Cementitious Material: Cementitious material must comply with Section 90-2.01C, "Required Use Of Supplementary Cementitious Materials," of the Standard Specifications and include one of the following:
 - 1. Cement complying with ASTM C 150, Type II, and supplementary cementitious material.
 - 2. Blended hydraulic cement complying with ASTM C 595, Type IP (MS).
- E. Lime: ASTM C207, hydrated, Type S.
- F. Mortar Sand: ASTM C144, natural sand, clean and graded.
- G. Mortar Coloring Pigment: ASTM C979, manufactured, inert mineral oxides in color or colors as selected and approved by the Engineer.
- H. Grout Aggregate: ASTM C33 or ASTM C404, clean and graded concrete aggregates, proportioned by volume as follows: 3 parts fine and graded concrete aggregate to 2 parts of graded 3/8-inch maximum size coarse aggregate. Soundness loss must not exceed 10 percent when tested under California Test 214.
- I. Water: Fresh, clean and potable, and free from such amounts of mineral and organic substances as would adversely affect the hardening of cement mortar.
- J. Epoxy Bonding Adhesive: Adhesive for bonding of mortar bed to concrete slabs shall be an epoxy-based bonding agent conforming to ASTM C881, Type V, tinted to show by visual inspection where it has been applied.

- K. Control Joint Materials: Conform with requirements of ACI 530.1.
- L. Joint Reinforcement: No. 9 gage ladder or truss type steel wire conforming to ACI 530.1.
- M. Reinforcing Steel: Provide reinforcing steel for grouted block masonry under this Section in accordance with the requirements of Section 52, "Reinforcement," of the Standard Specifications and the project special provisions, and ACI 530.1.

2.2 MORTAR

- A. Mortar Type and Mixing Requirements:
 - 1. Mortar for grouted unit masonry shall be Type S mortar in accordance with the California Building Code, Chapter 21 and 21A, ACI 530.1, and ASTM C270, with a minimum compressive strength at 28 days of 1,500 psi.
 - 2. The use of an admixture for the purpose of reducing water content in mortar will be permitted, provided the strength of the mortar is not reduced.
 - 3. Mortar shall be job mixed and, in lieu of specific requirements specified herein, shall conform with ASTM C270, including measurement, mixing, proportioning, and water retention.
 - 4. Accurately measure mortar ingredients and mix a minimum of three minutes after water has been added, in a mechanical batch mixer, using sufficient water to produce a workable and plastic consistency.
 - 5. Use mortar within 2-1/2 hours after mixing when air temperature is 80 degrees or higher, and within 3-1/2 hours when air temperature is below 80 degrees. Discard any mortar that has been mixed longer or that has begun to set. If necessary, mortar may be retempered within this time limit, by replacing only water lost due to evaporation and by thorough remixing.
- B. Colored Joint Mortar: Provide colored mortar for exposed masonry joints where indicated. Color shall be as approved by the Engineer from samples prepared and submitted by the Contractor. Pigment amount for selected color and mixing of colored mortar shall conform with the pigment manufacturer's instructions.

2.3 GROUT

- A. Grout shall be Coarse Grout, as defined in ASTM C476, with a minimum compressive strength at 28 days of 2,500 psi, and shall be proportioned by volume in accordance with ACI 530.1.
- B. Grout mix shall be designed in accordance with ASTM C94 for manufacturer designed mixes, and for handling by an approved grout pump. Slump shall be 10 inches.
- C. The use of an admixture for the purpose of reducing water content in grout and adding flowability will be permitted, provided the strength of the grout is not reduced. Admixture shall be added to the mix as recommended by the manufacturer for the purpose intended.

2.4 SURFACE SEALER

- A. Provide a water-based, VOC-compliant, clear, penetrating water-repellent sealer, designed to provide long-term protection against water absorption, for exterior concrete unit masonry surfaces. Submit sealer performance data and VOC compliance verification for approval.

PART 3 - EXECUTION

3.1 LAYING CONCRETE MASONRY UNITS

- A. Installation Standards: Comply with applicable requirements of ACI 530.1 and Section 2104, "Construction," of the CBC.
- B. Requirements: Construct concrete unit masonry to dimensions indicated. Concrete masonry units shall be dry when laid. Avoid using less than half-size units in exposed locations. Do not expose cells on any surface. Where concealed, spaces not large enough for full or half-size units may be filled with concrete building brick or mortar.
- C. Work Quality:
 - 1. Masonry work shall be performed by skilled and experienced masons. Erect walls plumb and true to line, with courses level and joints uniform in width, using specified mortar. Vertical joints shall line up plumb in exposed walls.

2. Concrete masonry units shall be sound and free of cracks and surface defects. Handle units carefully to avoid chipping and breaking. Do not substitute cut units where special shapes are available.
 3. Where pipes penetrate masonry, point neatly and accurately around pipes and ducts.
- D. Cutting of Units: Cutting of units shall be kept to a minimum. Perform cutting accurately to accommodate items passing through or embedded in masonry, to meet surfaces that masonry abuts, and to fit various conditions. Cutting of masonry units shall be performed with a power-driven masonry saw. Rub cuts smooth and even with carborundum or emery stone.
- E. Bedding and Jointing:
1. Use full mortar bed and coverage on horizontal and vertical face shells of hollow units. Webs also shall be bedded in mortar. Shove vertical joints tight.
 2. Top surfaces of concrete foundations or other bed joints shall be clean concrete with aggregate exposed before start of laying. Tops of foundations shall be roughened and cleaned to remove laitance for exposing aggregates in the concrete. Where block is to be laid on slabs, bed joints shall be roughened and cleaned, and an epoxy bonding adhesive shall be applied before laying first course of block.
- F. Joint Reinforcement: Provide ladder or truss type joint reinforcement, spaced a maximum of 16 inches on center vertically. Place in accordance with ACI 530.1, fully embedded in mortar.
- G. Bond Pattern: Lay masonry units in running bond.
- H. Alignment of Vertical Cells: Masonry shall be built to preserve the unobstructed vertical continuity of the cells. The vertical alignment shall be sufficient to maintain a clear, unobstructed vertical flue, measuring not less than 3 inches in all directions for grouted masonry.
- I. Cleanouts: Cleanout openings shall be provided at the bottoms of cells to be filled with grout. Mortar droppings shall be removed from cells, and cleanouts shall be sealed after inspection and before grout placement.
- J. Pipe Chases: Chases and recesses for pipes shall be formed as masonry work is constructed. Do not enclose piping until it has been tested and approved. Make such chases and recesses plumb, with inside joints struck flush, and the interiors kept free of obstructions and cleaned-out upon completion.
- K. Anchorage and Embedded Items:
1. Set accurately in place and bond into masonry, as the masonry work progresses, bolts, straps, hangers, sleeves, anchors, inserts, frames for doors and louvers, and any other anchorage items or attachments as indicated. Provide suitable recesses for other items to be built into masonry. Consult with other trades in advance so their work can be accommodated at correct locations, as masonry work progresses, to avoid cutting and patching.
 2. Cells containing anchorage or built-in items shall be grouted solid.
 3. Where masonry is laid against concrete or metal, the joints between shall be filled with mortar as each course is laid.
- L. Joint Finishing:
1. Pack mortar tightly in joints and wipe wall faces clean as work progresses. Unless otherwise indicated, exposed joints shall be densely tooled concave and smooth with joint tool when mortar is thumbprint hard.
 2. Rake out joints around metal frames in openings 3/4-inch deep for sealant to be applied.
 3. Nominal joint size, both vertical and horizontal, shall be 3/8 inch.
- M. Joining Work: Step back unfinished work for joining with new work. Toothing shall be resorted to only where unavoidable. Before starting or resuming work, remove loose mortar and foreign matter from work in place, and clean all surfaces of work to be joined.
- N. Control Joints: Provide control joints where indicated. Comply with ACI 530.1.

3.2 REINFORCING STEEL

- A. Provide reinforcing steel for grouted masonry as indicated. Comply with applicable requirements of ACI 530.1 and Section 52, "Reinforcement," of the Standard Specifications, and the project special provisions .

- B. Vertical reinforcing bars shall be placed prior to laying the wall and shall be held in place by standard reinforcing supports. Vertical bars shall be held in position at top and bottom and at intervals not exceeding 190 diameters of the reinforcement or 9 feet, whichever is less. Vertical reinforcing steel shall have a minimum clearance of 1 inch from the masonry. Tolerances for the placement of vertical reinforcement must be $\pm \frac{1}{2}$ inch.
- C. When a foundation dowel does not line up with a vertical core, it shall not be sloped more than one horizontal in six vertical. Dowels shall be grouted into a core in vertical alignment, even though it is an adjacent cell to the vertical wall reinforcing.
- D. Horizontal reinforcing bars for bond-beam or channel units shall be laid on the webs of the units in continuous masonry courses, and shall be solidly embedded in mortar and grout. Horizontal bars shall be tied to vertical bars as the block work progresses. Placing of horizontal reinforcing bars in mortar joints will not be permitted.
- E. Reinforcing bars shall be straight except for bends around corners and where bends or hooks are indicated.
- F. Reinforcing steel shall be lapped in accordance with ACI 530, Chapter 8. Length of lapped splices shall be not less than 40 bar diameters. Lapped splice bars shall be wire-tied together for the entire length of the splice.

3.3 GROUTING

- A. Grouting Requirements:
 - 1. All cells of concrete unit masonry shall be filled solid with grout. Cells containing reinforcement and anchorage or built-in items shall be filled solid with grout. Comply with applicable requirements of ACI 530.1.
 - 2. Spaces around metal frames and other built-in items shall be filled solid with grout or mortar.
 - 3. Reinforcing steel shall be secured in place, inspected, and approved before grouting starts.
 - 4. Mortar droppings and projections shall be kept out of the grout space. Webs, wythes, and reinforcement shall be cleaned of mortar droppings before grout is placed.
 - 5. Grout shall be rodded, puddled, or vibrated in place.
 - 6. Cells shall be filled solid with grout, and pours shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints, except if the joint is at a bond beam, the joint must be $\frac{1}{2}$ inch below the top of the bond beam unit or at the top of the wall.
 - 7. Grouting of beams over openings shall be performed in one continuous operation.
- B. Grout Construction:
 - 1. Grout construction, including grout placement and consolidation, shall conform with applicable requirements of ACI 530.1, except as otherwise specified herein.
 - 2. Grout shall be placed in lifts not to exceed 4 feet, with a waiting period of one hour between lifts. The full height of the wall or masonry section shall be placed in one day.
 - 3. Rod or vibrate grout thoroughly the entire height of the pour when first placed to push grout into all spaces and interstices. After the waiting period of an hour, place second lift and rod or vibrate the pour again to penetrate not more than half way into the first lift. Repeat this placing operation, waiting period, and consolidating technique until the top is reached. The top pour or lift shall likewise be reconsolidated after waiting period to allow excess water to be absorbed and escape.

3.4 REPAIRING AND POINTING

- A. Upon completion of the work, carefully examine masonry surfaces and cut out and replace broken or defective units. Install new units in fresh mortar to match adjoining units, and point joints to eliminate evidence of replacement. Rake out defective mortar joints and repoint.
- B. Remove protective paper. Clean surfaces and polish to uniform luster. Exercise care to avoid damage of finishes.
- C. Wash glass on interior and exterior to remove paint, soil, prints and foreign matter. Clean glass only with mild detergent and water following glass manufacturer's instructions. Do not use abrasive materials.

3.5 CLEANING

- A. After erection and pointing, masonry shall be cleaned down with stiff brushes and water, followed by a thorough rinsing with clean water. All mortar deposits, stains, or other foreign matter shall be removed from masonry surfaces.
- B. After masonry has been fully grouted, laitance and stains that have percolated through the blocks and mortar joints shall be hosed off with water under pressure.
- C. The Engineer may direct that certain masonry surfaces or areas be cleaned with a commercial masonry cleaner manufactured for the purpose, in which case follow the instructions or recommendations of the masonry-cleaner manufacturer for cleaning method.

3.6 CURING

- A. Masonry work and top of the grout pour shall be damp-cured for at least 7 days to prevent too rapid drying during hot or drying weather, and drying winds.
- B. Walls shall be kept moist or damp with water from a fogging nozzle, but shall not be wet to the point that free water drops from the surface.

3.7 SEALER APPLICATION

- A. Preparation: Surfaces receiving sealer shall be thoroughly dry and free of all construction stains, surface dirt, and efflorescence.
- B. Application: Apply sealer, where concrete unit masonry is exposed to the weather, in accordance with the manufacturer's application instructions and recommendations.

3.8 FIELD QUALITY CONTROL

- A. Special Inspection:
 - 1. The Contractor shall employ a special inspector and a testing laboratory to perform inspections and structural tests of masonry to verify the masonry construction conforms to Section 1704, "Special Inspections," and Section 2105, "Quality Assurance," of the CBC.
 - 2. Masonry special inspection personnel or testing laboratories used in the work must not be employed or compensated by any subcontractor, or by other persons or entities hired by subcontractors, who will provide other services or materials for the project.
 - 3. The special inspector must be, as a minimum, an ICC certified Structural Masonry Special Inspector. The special inspector must perform the inspections required under Section 1704.5, "Masonry construction" of the CBC.
 - 4. The special inspector must prepare a "Daily Field Report" providing information regarding the specific operations witnessed, including placing of CMUs and bar reinforcing, grouting, fabrication of test specimens, and other observations of importance to the work.
 - 5. A "Daily Field Report" is required for each day that the special inspector is on the jobsite. Deliver a copy of these reports to the Engineer on the day following the preparation.
 - 6. The special inspector must submit a final signed report to the Engineer and to you stating whether the work requiring special inspection was, to the best of the inspector's knowledge, in conformance with the approved plans, specifications, and the applicable workmanship provisions of these specifications and the CBC.
- B. Slump Tests: Perform slump tests of grout during grout placement in accordance with ASTM C1019 and ASTM C143.
- C. Strength Tests: Provide laboratory tests conforming to the following requirements:
 - 1. Concrete Masonry Units: Tensile strength tests shall be performed in accordance with ASTM C1006. Three units shall be tested for each 2,000 square feet of wall area.
 - 2. Mortar: Compressive strength tests shall be performed in accordance with ASTM C109. Three cubes shall be tested for each 2,000 square feet of wall area, one at seven days and two at 28 days.
 - 3. Grout: Compressive strength tests shall be performed in accordance with ASTM C1019. Three square prisms shall be tested for each 2,000 square feet, or fraction thereof, of wall area.
- D. Test Reports: Submit certified copies of all test results to the Engineer for record purposes.

- E. Rejection of Masonry; Repair and Replacement: The Engineer shall have authority to reject concrete masonry work that does not meet specification requirements, and to require repair or replacement as necessary to complete the concrete masonry work. Additionally, any work not meeting the requirements of Section 2105, "Quality Assurance," of the CBC, must be redone and retested. Sampling, inspecting, reworking, and retesting of material will be done at the Contractor's expense.

END OF SECTION

SECTION 053000
METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Floor Decking
 - 2. Accessories
 - 3. Galvanizing Repair Materials

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A446/A446M Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
 - 2. ASTM A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - 3. ASTM A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings Specification for Masonry Cement
- B. Steel Deck Institute (SDI):
 - 1. SDI Publication No. 27 Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Metal Floor Deck with Electrical Distribution Hot-Dip Process, Structural (Physical) Quality
- C. American Welding Society for Testing and Materials (AWS):
 - 1. AWS D1.1 Structural Welding Code – Steel
 - 2. AWS D1.3 Structural Welding Code – Sheet Steel

1.3 REGULATORY REQUIREMENTS

- A. In addition to the foregoing referenced standards, the regulatory requirements that govern the work of this Section include the following governing code:
California Code of Regulations (CCR), Title 24, Part 2, California Building Code, Chapter 21, "Masonry," and Chapter 21A, "Masonry."

1.4 SUBMITTALS

- A. Working Drawings: Submit detailed Working Drawings of metal decking, showing complete erection layouts, grade, size, section profile, and thickness of decking, lapping of decking, locations of welds, and method of attachment.
- B. Product Data: Submit manufacturer's product data and design data of the floor and roof decking, along with applicable accessories.
 - 1. Submit product data on galvanizing repair materials.
- C. Certification: Submit evidence that the shear capacity of manufacturer's decking has been accepted by the International Conference of Building Officials and that a valid Research Recommendation is on file.

1.5 QUALITY ASSURANCE

- A. Qualifications of Welders and Welding Procedures:
 - 1. Welding processes and welding operators shall be qualified in accordance with "Welder Qualification," procedures in American Welding Society (AWS) D1.1, "Structural Welding Code - Steel."
 - 2. Welding decking in place is subject to inspection and testing. Defective work shall be removed and replaced with acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Metal deck units and accessories shall be transported, stored and erected in a manner that will prevent corrosion, distortion or other damage.
- B. Deck units shall be stored off the ground with one end elevated to provide drainage.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Decking: Floor decking shall be formed of steel sheet conforming to ASTM A446/A446M, Grade B minimum, Coating Designation G90 (1.25 ounce commercial zinc coating) conforming to ASTM A653/A653M. Type of decking units, weight of metal (metal gage), and section profile shall be as indicated:
 - 1. Acceptable manufacturers shall be; Verco Manufacturing Co.; BHP Co.; or equal.
- B. Accessories: Provide cell end closures, column flashings, recessed sump pans, and any other closures and flashings as indicated or required for complete and finished installations and as required to prevent leakage of concrete. Provide cover caps for covering abutting ends where required. Accessories and flashings shall be of the same material and gage as the decking. Accessories shall be the decking manufacturer's standard types, galvanized, and shall be provided as follows:
 - 1. Adjusting plates or segments of deck units in locations too narrow to accommodate full-size units.
 - 2. End closures to close the open ends at openings, where units terminate at exterior walls, and other locations where required. Closures shall be not lighter than the same gage as the adjacent deck units.
 - 3. Closures for closing voids above interior walls and partitions that are perpendicular to the direction of the flutes or corrugations. Closures above typical partitions shall be compressible closed cell neoprene or vinyl synthetic rubber.
- C. Galvanizing Repair Materials: Conform with requirements of ASTM A780. Commercial cold galvanizing compounds manufactured for the purpose will be accepted provided they meet or exceed requirements of ASTM A780.

2.2 FABRICATION

- A. Metal decking and associated metal fabrications shall conform with applicable requirements of the California Building Code, Chapters 22 and 22A, and SDI Publication No. 27.
- B. Deck units shall be formed to span 2 or more supports.
- C. Fabricate decking for composite construction with shear studs or lugs to provide mechanical key for transferring horizontal shear and for preventing vertical separation. Provide decking with shear studs and hold-down lugs to achieve composite action between decking and concrete fill.
- D. Welding shall conform to AWS requirements (D1.1 and D1.3) and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- E. Steel decking and associated fabrications shall be prefabricated and preassembled in the factory or shop as far as practicable.
- F. Galvanized metalwork necessitating welding which in any manner removes or damages original galvanizing shall be restored by galvanizing repair in accordance with ASTM A780.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Install decking as indicated and in accordance with the approved submittals and the decking manufacturer's installation instructions. Provide decking complete, including shaping, cutting, fitting, drilling, welding, flashings, closure strips, closure plates, fasteners, and accessories necessary for a complete and finished installation.
- B. Install decking in straight and continuous rows as far as practicable, with ribs at right angles to structural supporting members. End laps shall occur over bearings only, and where sheets are lapped, end laps shall be not less than 2 inches. Where ends of decking sheets abut without overlapping at supports, each end of decking shall have a minimum bearing of 2½ inch on supports.

- C. Type of welding, number of welds, size of welds, and locations of welds shall be in accordance with the approved Shop Drawings and the decking manufacturer's installation instructions. Welding shall conform to AWS requirements (D1.1 and D1.3) and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Welds shall be cleaned immediately by wire-brushing, and shall be coated with galvanizing repair material before being covered by the succeeding sheet.
- E. Decking shall be weighted at the point of welding with sand bags or other approved method to hold them in firm contact with each other and structural supports.
- F. Secure solid welds where sheets are warped or bent to certain radii and where decking is placed on a slope while supporting members are framed in a straight position.
- G. Button punches or crimping devices may not be substituted for welding.
- H. Holes and openings for services and other projections through decking shall be cut and fitted neatly and accurately and shall be reinforced as necessary for rigidity and load-carrying capacity.

3.2 GALVANIZING REPAIR

- A. Galvanized surfaces which have become damaged from welding, handling, or installation shall be repaired immediately after installation with galvanizing repair material in accordance with ASTM A780. Galvanizing repair shall be performed and completed before concrete is placed.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rough hardware.
 - 2. Miscellaneous Metals

1.2 SUBMITTALS

- A. Product Data: Submit product data for manufactured components indicating type, finish, size, accessories, and anchorage details.
- B. Shop Drawings:
 - 1. Indicate profiles, dimensions, fabrication and installation details, size and type of fasteners, welds, accessory items, shop finish and method of anchorage.
 - 2. Stamp shop drawings with seal and signature of professional engineer responsible for design.
- C. Submit following Informational Submittals: Certifications specified in Quality Assurance article.

1.3 QUALITY ASSURANCE

- A. Certifications: Fabricator's statement indicating fabrications are designed, fabricated, and installed to comply with code and Contract Document loading.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.

PART 2 - PRODUCTS

2.1 FERROUS METALS, GENERAL

- A. Steel Plates, Shapes and Bars: ASTM A36.
 - 1. Steel: Maximize use of recycled steel with minimum of 30 percent.
- B. Steel Tubing: Cold-formed, ASTM A500.
- C. Structural Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Class 1; of grade required for design loading.
- D. Galvanized Structural Steel Sheet: ASTM A653, of grade required for design loading. Coating designation; G90.
- E. Steel Pipe: ASTM A53; type and grade (if applicable) as selected by fabricator and as required for design loading; black finish unless otherwise indicated.

2.2 SURFACE PREPARATION AND APPLICATION

- A. Steel surfaces to be primed must be dry and free of dirt, oils, rust, salt and other contaminants.
- B. Blast-clean steel to "commercial grade" SSPC SP-6 for general use.
- C. Apply primers in accordance with manufacturer's instructions.

2.3 UNIVERSAL PRIMER

- A. Locations: Interior steel in conditioned space.
- B. Manufacturer's standard, lead free primer, capable of providing sound foundation for field applied top coats despite prolonged exposure.
- C. Standard: FS TT-P-645.
- D. Maximum Allowable Dry Time: 4 hours to touch; 24 hours to re-coat.
- E. Compatible with finish paint system specified in 099000.

- F. Acceptable Products:
 - 1. Series 115 Uni-Bond, Tnemec Company, Inc., Kansas City, MO.
 - 2. Carboguard 890 VOC, Carboline Company, St. Louis, MO.

2.4 ZINC-RICH PRIMER

- A. Locations: Exterior or areas subject to unconditioned, high humidity.
- B. Inorganic, zinc-rich, capable of providing sound foundation for field applied top coats despite prolonged exposure, cathodic protection and corrosion resistance. Similar to galvanizing.
 - 1. Pigment Content: Minimum 63% zinc in dry film by weight.
 - 2. Compatible with finish paint system specified in 099000.
 - 3. Acceptable Products:
 - a. Tnemec H90-97 Tneme-Zinc, Tnemec Co., Kansas City, MO.
 - b. Carbo-Zinc 859 VOC, Carboline Company, St. Louis, MO.
 - c. ZRC Cold Galvanizing Compound, ZRC Products Company, Quincy, MA.

2.5 FABRICATION, GENERAL

- A. Field verify dimensions prior to shop fabrication.
- B. Minimize joints and seams by using largest stock sizes practical.
- C. Locate multiple joints at regular intervals and at least conspicuous locations.
- D. Form flush, tight, hairline joints and seams. Continuously weld joints and seams to develop the full strength of the jointed members.
- E. Miter exposed joints. Grind exposed welds, seams and joints to form a smooth, uniform surface.
- F. Weld in accord with AWS D1.1 for materials being welded.
- G. Ease exposed edges to a minimum, uniform radius of 1/32 inch.
- H. Fit and shop assemble sections in largest sizes practical for site delivery.
- I. Fabricate work to exclude rain and condensate or provide weep holes to divert water to the exterior.
- J. Form break metal corners to the smallest radius possible without distressing the finish surface.
- K. Cut, drill, punch, tap, reinforce and provide anchors to accommodate adjoining work and hardware.
- L. Provide anchors, bolts, rough hardware, fasteners and accessories required to incorporate and secure fabrications and to make the units functionally operational.
- M. Use countersunk, flat head screws and bolts at exposed joints requiring mechanical fasteners.
- N. At exposed work, use materials which are smooth, free of surface blemishes, pitting, seam marks, roller marks, trade names and roughness.

2.6 ROUGH HARDWARE

- A. Furnish bent or custom fabricated bolts, plates, anchors, hangers, dowels and miscellaneous steel and iron shapes required for framing, supporting, anchoring or securing fixtures, accessories, and furnishings.
- B. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
- C. Fabricate items to sizes, shapes and dimensions required.
- D. Furnish steel washers, except use malleable-iron washers for heads and nuts which bear on wood structural connections.
- E. Finish: Same as item being supported or anchored.

2.7 ANGLE FRAMES AND EDGE ANGLES

- A. Complete with anchors and bolts. For casting in concrete, space anchors 24 inches OC with 1-1/4 inches by 1/4 inch by 8 inches steel straps.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.
- B. Coordinate and furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors which are embedded in concrete or masonry construction.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling and fitting required for installation of fabrications.
- B. Set work accurately to established lines and levels.
- C. Provide temporary bracing and anchors for items which are to be built into concrete, masonry or similar construction.
- D. Fit exposed connections together to form tight hairline joints. Weld connections which are left as exposed joints.
- E. Grind exposed joints smooth and touch-up shop paint.
- F. Do not weld, cut or abrade galvanized surfaces of bolted or screwed connections.
- G. Field Welding; comply with AWS Code D1.1.
- H. Clean concrete and masonry bearing surfaces of any bond-reducing materials; roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- I. Set loose leveling and bearing plates on wedges, or adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut flush with edge of bearing plate before packing with grout.

3.3 ADJUST AND CLEAN

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas and paint with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION

SECTION 057000
DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Stainless Steel Welded Wire Mesh

1.2 SUBMITTALS

- A. Product Data: Submit product data for manufactured components indicating type, finish, size, accessories, and anchorage details.
- B. Shop Drawings:
 - 1. Indicate profiles, dimensions, fabrication and installation details, size and type of fasteners, welds, accessory items, shop finish and method of anchorage.
 - 2. Stamp shop drawings with seal and signature of professional engineer responsible for design.
- C. Submit following Informational Submittals: Certifications specified in Quality Assurance article.

1.3 QUALITY ASSURANCE

- A. Certifications: Fabricator's statement indicating fabrications are designed, fabricated, and installed to comply with code and Contract Document loading.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Stainless Steel Wire Mesh
 - 1. Basis of Design: McNichols 2" Square Opening Wire Mesh 0.1880" or approved equal

2.2 ACCESSORIES

- A. Stainless Steel Trim Edge as indicated in drawings.

2.3 FABRICATION, GENERAL

- A. Field verify dimensions prior to shop fabrication.
- B. Minimize joints and seams by using largest stock sizes practical.
- C. Locate multiple joints at regular intervals and at least conspicuous locations.
- D. Form flush, tight, hairline joints and seams. Continuously weld joints and seams to develop the full strength of the jointed members.
- E. Miter exposed joints. Grind exposed welds, seams and joints to form a smooth, uniform surface.
- F. Weld in accord with AWS D1.1 for materials being welded.
- G. Ease exposed edges to a minimum, uniform radius of 1/32 inch.
- H. Fit and shop assemble sections in largest sizes practical for site delivery.
- I. Fabricate work to exclude rain and condensate or provide weep holes to divert water to the exterior.
- J. Form break metal corners to the smallest radius possible without distressing the finish surface.
- K. Cut, drill, punch, tap, reinforce and provide anchors to accommodate adjoining work and hardware.

- L. Provide anchors, bolts, rough hardware, fasteners and accessories required to incorporate and secure fabrications and to make the units functionally operational.
- M. Use countersunk, flat head screws and bolts at exposed joints requiring mechanical fasteners.
- N. At exposed work, use materials which are smooth, free of surface blemishes, pitting, seam marks, roller marks, trade names and roughness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling and fitting required for installation of fabrications.
- B. Set work accurately to established lines and levels.
- C. Fit exposed connections together to form tight hairline joints. Weld connections which are left as exposed joints.
- D. Grind exposed joints smooth and touch-up.
- E. Do not weld, cut or abrade frames and mesh which have been finished after fabrication and are to be field connected by mechanical means.
- F. Field Welding; comply with AWS Code D1.1.

3.3 ADJUSTING AND CLEANING

- A. Protect finishes of mesh from damage during construction by use of temporary protective coverings approved by manufacturer. Remove protective covering at project completion. Restore finishes damaged during installation and construction period.

END OF SECTION

SECTION 057300
STAINLESS STEEL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Exterior Stainless steel railings at site locations indicated in drawings.

1.2 SYSTEM REQUIREMENTS

- A. Design Requirements:
1. Fabricator is responsible for designing units, including anchorage to concrete slab and necessary modifications to meet specified requirements and maintain visual design concepts.
 2. Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, and profiles of units.
 3. Provide concealed fastening wherever possible.
- B. Structural Requirements: Provide assemblies which, when installed, comply with the following minimum requirements for structural performance:
1. Guards: Capable of withstanding following loads applied as indicated.
 - a. Concentrated load of 200 pounds applied at any point along the top, in any direction, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building.
 - b. Uniform load of 50 PLF applied in any direction at the top and to transfer this load through the supports to the structure.
 - c. Concentrated and uniform loads above need not be applied simultaneously.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate locations and complete fabrication details, materials, finishes, and installation details.
- B. Submit following Informational Submittals: Manufacturer's instructions.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating work specified in this Section with minimum 5 years documented experience.
- B. Welder Qualifications: AWS certified within past 12 months for each type of weld required.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel:
1. Pipe: ASTM A312, Grade TP 316.
 2. Tubing: ASTM A554, Grade MT 304.
 3. Castings: ASTM A743, Grade CF-8 or CF-20.
 4. Shapes: ASTM A276, UNS Number S31600.

2.2 GROUT

- A. Non-Shrink Grout:
1. Pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives.
 2. Minimum strength at 28 days: 5000 psi.
 3. Comply with ASTM C1107.

4. Acceptable Products:
 - a. Crystex, L&M Construction Chemicals, Omaha, NE.
 - b. Masterflow 713, Master Builders, Cleveland, OH.
 - c. Euco Rock Anchor Bolt Grout, Euclid Chemical Co., Cleveland, OH.
 - d. SikaGrout 212, Sika Corporation, Lyndhurst, NJ.
 - e. Five Star Grout, Five Star Products, Fairfield, CT.

B. Fasteners: As recommended by manufacturer for conditions encountered.

2.3 FABRICATION

A. General:

1. Verify dimensions on site prior to fabrication.
2. Fabricate to support design loads specified.
3. Fit and shop assemble in largest practical sizes.
4. Fabricate materials straight and true, without scratches, scars, creases, buckles, ripples, or chatter marks, free from surface blemishes.

B. Connections:

1. Stainless Steel Custom Design: Fabricate for connection of members by welding; comply with AWS for recommended practices; grind exposed welds smooth and flush.

C. Brackets, Flanges, Fittings, and Anchors:

1. Provide brackets, flanges, miscellaneous fittings and anchors for interconnection of railing members as indicated on Drawings.

D. Joints: Mill to tight, hairline fit.

E. Ends: Capped.

F. Bends: Form by prefabricated elbow fittings and radius bends, except where configuration requires bending of railing members.

2.4 FINISHES

A. Stainless Steel: No. 4 brushed finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with work when substrates are ready.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Fit exposed connections to form tight, hairline joints.

C. Set work accurately in location, set posts and align to within 1/4 inch in 12 feet.

D. Do not weld, cut or abrade railings which have been finished after fabrication and are to be field connected by mechanical means.

E. Anchoring Posts:

1. Concrete:
 - a. Anchor posts in concrete by means of core drilling holes.
 - b. Fill annular space between posts and sleeves solid with non-shrink, non-metallic grout.
 - c. Leave anchorage joint exposed; wipe off excess grout and leave flush with adjacent floor.

3.3 ADJUSTING AND CLEANING

A. Protect finishes of railings from damage during construction by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at project completion. Restore finishes damaged during installation and construction period.

END OF SECTION

SECTION 058100
EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Expansion joint assemblies

1.2 RELATED SECTIONS

- A. Control joints for unit masonry are specified in Section 04 22 00 - Concrete Unit Masonry.
B. Sealants for sealing of perimeter joints at openings in walls and for joints at abutting materials are specified in Section 07 92 00 – Sealants.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. ASTM A240 Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
 2. ASTM A480 Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
 3. ASTM B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
 4. ASTM C509 Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
 5. ASTM C834 Specification for Latex Sealants
 6. ASTM C920 Specification for Elastomeric Joint Sealants
 7. ASTM C1085 Specification for Butyl Rubber-Based Solvent-Release Sealants
 8. ASTM F738 Specification for Stainless Steel Metric Bolts, Screws, and Studs

1.4 SUBMITTALS

- A. Product Data and Working Drawings: Submit manufacturers' product data of expansion-joint closures, assemblies, seals, and sealants for review. Include installation details.

PART 2 - PRODUCTS

2.1 EXPANSION JOINT ASSEMBLIES

- A. Expansion joint closures and seals shall be aluminum extrusions, neoprene rubber seals, and ethylene propylene diene monomer (EPDM) covers of type and size to suit the construction as indicated.
1. Acceptable Manufacturers: Subject to these specifications conditions, acceptable manufacturers shall be D. S. Brown Co.; General Tire Engineered Construction Products; Watson Bowman and Acme Corp. (Wabco); or equal.
 2. Molded Elastomeric Hinged Cover System: Watson Bowman and Acme Corp. (Wabco) Wabo-SafetyFlex cover for expansion joint openings; or equal.
 3. Functional Seal: Closed cell neoprene synthetic rubber conforming with ASTM C509, medium density. Watson Bowman and Acme Corp. (Wabco) Wabo-InverSeal preformed joint seal; or equal.
 4. Fasteners: Fasteners shall be the expansion joint assembly manufacturer's standard corrosion resistant fasteners.
 5. Sealant: Sealant for installation behind aluminum retainer, in rear pocket of aluminum retainer, and at joints, where indicated, shall conform to ASTM C834, C920, or C1085 as appropriate for the construction and exposure conditions, and as recommended by the expansion joint assembly manufacturer.

PART 3 - EXECUTION

3.1 PREPERATION

- A. Surface Preparation: Supporting joint surfaces shall be prepared as recommended by the manufacturer. Edges of the substrate shall be level and sound.

3.2 INSTALLATION

- A. Expansion Joint Assemblies: Install expansion-joint assemblies and engineered floor and wall seals as indicated and in accordance with the approved Working Drawings and the manufacturer's installation instructions and recommendations.

3.3 CLEANING

- A. Unused materials, containers, and equipment shall be removed from the work area.
- B. Surfaces that are stained, marred or otherwise damaged shall be cleaned and repaired.

END OF SECTION

SECTION 061500
WOOD DECKING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hardwood Decking for stairs and seating areas as indicated on Architectural Drawings
 - 2. Pressure Treated Sleepers and Structural Framing
 - 3. Stainless Steel fasteners and connectors

1.2 SUBMITTALS

- A. Prior to installation, contractor to provide the following information:
 - 1. Standard printed specification of hardwood and related items to be installed.
 - 2. Shop Drawings: Indicate details necessary for a complete installation, including spacing and sizes of connections and members, finishes of members, and other necessary information.
 - 3. Samples: Submit samples of finishes and colors of materials for approval by Engineer.
- B. Upon completion of specified work, contractor to provide closeout submittals as listed below.
 - 1. Provide a care and maintenance manual for the Owner's use for future maintenance of the installed system.
 - 2. Warranty: Submit specified warranty

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Selected contractor shall have a minimum five (5) years experience with installations of similar material and design with a record of successful in-service performance.
- B. Source Limitations: Obtain all materials and products from one source with resources to provide natural materials and products of consistent quality in appearance and physical properties.
- C. Regulatory Requirements: Contractor to ensure installation complies with all applicable building codes.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.
 - 1. Allow materials to adjust to climate and temperature
- B. Protect finish surfaces as necessary to prevent damage.

PART 2 - PRODUCTS

2.1 HARDWOOD DECKING

- A. Basis of Design: Ipe Hardwood Decking
 - 1. Use only wood indicated for outdoor use.
 - 2. Natural Weathering; wood to remain untreated

2.2 PRESSURE TREATED SLEEPERS AND STRUCTURAL FRAMING

- A. Refer to drawings for design intent. Contractor to indicate scope of material within shop drawings.

2.3 STAINLESS STEEL FASTNERS AND CONNECTORS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions, details and approved shop drawings.

- B. Erect true to line, plumb, level, square and in proper planes with other work, free from twists, sags, waves, buckles or other objectionable defects.
- C. Provide anchorage to safely resist stresses to which members will normally be subjected.
- D. Anchor securely in place allowing for required movement including expansion and contraction.

3.3 CLEANING / PROTECTING

- A. Touchup damaged decking at completion of installation.
- B. Replace damaged decking that cannot be successfully repaired, as approved by the Engineer, to match adjacent decking, at no cost to the owner.
- C. Protect finish floor from construction damage and traffic by covering as approved by manufacturer.
- D. Remove protective covering at project completion.

END OF SECTION

SECTION 076000
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sheet metal flashing, counterflashing, and associated trim.

1.2 REFERENCES

- A. Reference Standards: Comply with applicable provisions for design, materials, fabrication, and installation of component parts of Sheet Metal and Air Conditioning Contractors National Association (SMACNA), 6th Edition.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate typical layout including dimensions, configuration, locations, interface with adjacent systems, clearances, tolerances, frequency of attachment, and fabrication details.
 - 2. Submit detail drawings of transitions, intersections, and connections.

1.4 QUALITY ASSURANCE

- A. Fabricator's Qualifications: Company specializing in sheet metal flashing work with 3 years documented experience in similar size and type of installations.
- B. Certifications: Submit fabricator's certification that products furnished for Project meet or exceed specified requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.
- B. Stack pre-formed material to prevent twisting, bending, and abrasions, and to provide ventilation.
- C. Prevent contact with materials which may cause discoloration or staining.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Sheet:
 - 1. General: Zinc coating, hot dip galvanized, flattened sheets, chemically treated.
 - 2. Commercial Quality: ASTM A653, G90
 - 3. Lock-Forming Quality: ASTM A653, G90
 - 4. Thickness: As indicated on Drawings; 24 gage minimum or as recommended in Architectural Sheet Metal Manual for intended purposes.
 - 5. Finish: Mill phosphatized where indicated for painting.

2.2 ACCESSORIES

- A. Fasteners:
 - 1. Materials: AISI Series 300 for stainless and galvanized steel; aluminum for aluminum sheets.
 - 2. Screws and Bolts: Sufficient size and length to sustain imposed stresses.
- B. Solder Materials:
 - 1. Flux: Type as recommended by sheet material manufacturer; not detrimental to base material.
 - 2. Solder: ASTM B32, 50 percent tin/50 percent lead for galvanized steel.
- C. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, containing no asbestos fibers, compounded for 15 mil dry film thickness per coat.

- D. Sealants:
 - 1. Silicone—General Purpose sealant specified in Section 079200.
 - 2. Color as selected by engineer from full range of manufacturer's standard colors.

2.3 FABRICATION

- A. General:
 - 1. Shop fabricate components to maximum extent possible to minimize site fabrication.
 - 2. Fabricate to allow for adjustments in field for proper anchoring and joining.
 - 3. Form sections true to shape, accurate in size, square, free from distortion and defects.
 - 4. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.
 - 5. Fabricate corners from one piece with minimum 18 inch long legs; solder for rigidity; seal with sealant.
 - 6. Solder
 - a. Solder and seal metal joints except those indicated or required to be expansive type joints.
 - b. After soldering, remove flux. Wipe and wash solder joints clean.
- B. Seams:
 - 1. Provide following seam types unless noted or detailed otherwise.
 - 2. Flat: Overlapped and sealed.
- C. Sheet Metal Thickness/Mass:
 - 1. Flashing: In accordance with SMACNA Chapter 4.
- D. Flashing and Counter Flashing:
 - 1. Fabricate as indicated on Drawings and in accordance with SMACNA Architectural Sheet Metal Manual, Chapter 4.
 - 2. Hem exposed flashings on underside 1/2 inch; miter and seam corners.
 - 3. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
 - 4. Fabricate flashings to allow toe to extend minimum 2 inches over wall surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.

3.2 PREPARATION

- A. Field measure site conditions prior to fabricating work.
- B. Install edge strips and cleats before starting installation.

3.3 INSTALLATION

- A. General:
 - 1. Install metal work in accordance with SMACNA.
 - 2. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.
 - 3. Apply asphalt mastic on metal surfaces of units in contact with cementitious materials and dissimilar metals.
 - 4. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
 - 5. Miter, lap seam and close corner joints with solder. Seal seams and joints watertight.
 - 6. Install expansion joints at frequency recommended by SMACNA. Do not fasten seams such that movement is restricted.
 - 7. Coordinate with installation of roofing system and roof accessories.
- B. Flashing
 - 1. Secure flashings in place using concealed fasteners.
 - 2. Use exposed fasteners only in locations approved by engineer.

3.4 CLEANING

- A. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with washing soda solution, and then flushing clear water rinse. Use special care to neutralize and clean crevices.

END OF SECTION

SECTION 079200
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Sections:
1. Section 076000 - Flashing and Sheet Metal.

1.2 DEFINITIONS

- A. Use definitions in ASTM C717.
B. Non-Bleeding: Not capable of exuding liquid chemical components of sealant.
C. Non-Staining: Not capable of discoloring joint substrate.
D. One-Stage Sealing: Weatherproof sealing of joints at the exterior face of the wall section; sealant acts as both water and air seal.
E. Primary Seal: Deflector seal in two-stage sealing.
F. Sealant System: Sealant, sealant backing, and primer intended for use in particular condition.

1.3 SUBMITTALS

- A. Product Data:
1. Submit product data and product specifications for each product.
2. Include data to indicate chemical characteristics, performance criteria, limitations, substrate preparation, installation requirements, and curing requirements.
3. Include information for accessories and other required components.
4. Include color charts indicating manufacturer's full color range available of each sealant type for engineer's initial selection.
B. Samples: Submit four 1/4 inch diameter by 2 inch long samples illustrating sealant colors for each product exposed to view.
C. Submit following Informational Submittals:
1. Test Reports: Submit written results of testing specified as part of Source and Field Quality Control articles.
2. Certifications specified in Quality Assurance article.
3. Qualification Data: Manufacturer's and installer's qualification data.
4. Manufacturer's instructions. Include requirements for surface preparation, priming, joint size ratios, adhesion testing, and perimeter conditions requiring special attention.
5. Manufacturer's field reports.
D. Closeout Submittals:
1. Warranty: Submit specified warranty.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility:
1. Provide products for each sealant system from one manufacturer for entire Project, unless otherwise acceptable to engineer.
2. Provide products from a single manufacturer to ensure material compatibility where different sealant materials come in direct contact with each other.
3. Provide each sealant system as complete unit, including accessory items necessary for proper function.
B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum 5 years experience.
C. Applicator Qualifications: Acceptable to manufacturer, specializing in applying sealants, with experience on at least 5 projects of similar nature in past 5 years.
D. Certifications:

1. Manufacturer's Certification that Products:
 - a. Furnished for Project meet or exceed specified requirements.
 - b. Assembled for each joint are compatible with each other and with joint substrates under conditions of service and application.
 - c. Are suitable for the indicated use.
2. Manufacturer's certification that sealants, primers, and cleaners, comply with local regulations controlling the use of volatile organic compounds.
3. Contractor's and installer's certification that products are installed in accordance with Contract Documents, based on inspection and testing specified as part of Field Quality Control.

1.5 PRE-INSTALLATION CONFERENCE

- A. Conduct pre-installation conference.
- B. Convene pre-installation conference 3 weeks prior to commencing work of this Section.
- C. Conference Purpose and Agenda:
 1. Visit Project site to analyze site conditions, and inspect surfaces and joints to be sealed in order that recommendations may be made should adverse conditions exist.
 2. Review mock-up and field sample.
 3. Discuss following items:
 - a. Substrate conditions.
 - b. Preparatory work.
 - c. Weather conditions under which work will be done.
 - d. Anticipated frequency and extent of joint movement.
 - e. Joint design.
 - f. Sealant installation procedures.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.
- B. Deliver materials to site in unopened containers and bundles with labels indicating:
 1. Manufacturer's name.
 2. Product name and designation.
 3. Color.
 4. Expiration period for use.
 5. Working life.
 6. Curing time.
 7. Mixing instructions for multi-component materials.
- C. Storage and Protection:
 1. Store products within manufacturer's required temperature and humidity ranges.
 2. Prior to use, condition products within manufacturer's required temperature range, humidity range, and time period.

1.7 PROJECT CONDITIONS

- A. Environmental Requirements:
 1. Apply sealant when the following are within manufacturer's limits during and for 24 hours after sealant installation:
 2. Ambient and surface temperatures.
 3. Relative humidity.
 4. Do not apply sealants to wet or frozen surfaces.
 5. Comply with manufacturer's requirements regarding application of sealants in vicinity of curing sealants of a different material.

1.8 WARRANTY

- A. Warrant installed products to be free from defects in material, labor, or installation techniques for 20 years on silicones used at exterior building envelope, 2 years at sealants used at interior locations.

- B. Include coverage for installed sealants and accessories which:
 - 1. Fail to achieve air tight seal.
 - 2. Fail to achieve watertight seal.
 - 3. Exhibit loss of adhesion.
 - 4. Exhibit loss of cohesion.
 - 5. Do not cure.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acrylic Latex (Designation AL):
 - 1. Description:
 - a. ASTM C834.
 - b. Non-sag; non-staining; non-bleeding.
 - c. Joint movement range without cohesive/adhesive failure: Plus 7.5 percent to minus 7.5 percent of joint width.
 - d. Color: As selected by engineer from manufacturer's full color range.
 - 2. Acceptable Products:
 - a. AC-20, Pecora Corporation.
 - b. Sonolac, Sonneborn Building Products.
 - c. Acrylic Latex Tremflex 834, Tremco, Inc.
- B. Silicone—General Purpose (Designation S-GP):
 - 1. Description:
 - a. ASTM C920:
 - 1) Type: S
 - 2) Grade: NS
 - 3) Class: 25
 - 4) Uses: NT, M, G, A, O
 - b. Single component, neutral curing, non-staining, non-bleeding silicone sealant.
 - c. Medium modulus silicone for metal to metal and metal to adjacent substrates; Low modulus silicone for all other locations.
 - d. Joint movement range without cohesive/adhesive failure: Plus 50 percent to minus 50 percent of joint width.
 - e. Color: Selected by engineer from manufacturer's full color range.
 - f. Acceptable Medium Modulus Products:
 - 1) 795, Dow Corning.
 - 2) Silpruf, General Electric.
 - 3) Spectrem 2, Tremco.
 - g. Acceptable Low Modulus
 - 1) 790, Dow Corning.
 - 2) 890, Pecora.
 - 3) Spectrem 1, Tremco.
- C. Silicone—Sanitary (Designation S-S):
 - 1. Description:
 - a. ASTM C920:
 - 1) Type: S
 - 2) Grade: NS
 - 3) Class: 25
 - 4) Uses: NT, M, G, A, O
 - b. Neutral or acid curing, non-staining, non-bleeding, fungicide-containing.
 - c. Color: Selected by engineer from manufacturer's full color range.
 - 2. Acceptable Products:
 - a. 786 Mildew-Resistant Silicone Sealant, The Dow Chemical Company.
 - b. Sanitary 1700, General Electric Silicones.
 - c. Tremsil 200 Sanitary, Tremco
- D. Urethane—Traffic-Bearing (Designation U-TB): ASTM C920, Type M, Grade P:

1. Sealant containing mercury not allowed.
2. Class: 25. Joint movement range without cohesive/adhesive failure: Plus 25 percent to minus 25 percent of joint width.
3. Uses: T, M, O
4. Chemical curing, non-staining, non-bleeding.
5. Shore A Hardness: 40 minimum, when tested in accordance with ASTM C661.
6. Color: As selected by engineer from complete range available from manufacturer.
7. Acceptable Products.
 - a. NR-200, Pecora.
 - b. Vulkem 245, Tremco.
 - c. Sikaflex 2c/SL, Sika.
 - d. SL 2 Sealant, Sonneborn Division of BASF Building Systems, Shakopee, MN.
 - e. THC-900, Tremco.

2.2 ACCESSORIES

- A. Joint Cleaner:
 1. Chemical cleaners required by sealant manufacturer for substrates encountered, compatible with sealant backing bond breaker materials.
 2. Free of substances capable of staining, corroding, or harming:
 - a. Joint substrates.
 - b. Adjacent nonporous surfaces.
 - c. Sealant.
 - d. Sealant backing.
 3. Formulated to promote optimum adhesion of sealants to joint substrates.
- B. Primer:
 1. Dyed coating material required by sealant manufacturer for enhancing sealant adhesion to joint substrates.
 2. Non-staining to joint substrate beyond the substrate surface.
 3. Required for use unless not required by results of:
 - a. "Manufacturer's sealant-substrate compatibility and adhesion test" described under Source Quality Control.
 - b. "Field hand-pull adhesion test" under Field Quality Control.
- C. Sealant Backing Bond Breaker Rod:
 1. Non-staining material.
 2. Compatible and non-adhering to sealant when tested in accordance with ASTM C1087.
 3. Compatible with sealant, joint substrates, primers, and other sealant backing bond breakers.
 4. Sealant manufacturer approved.
 5. Sized and shaped to provide optimum performance and backing to sealant.
 6. Preformed, compressible, resilient, non-staining, non-outgassing, non-waxing, non-extruding, cylinder-shaped plastic foam rods compliant with ASTM D1056.
 7. Open Cell Polyurethane: Use not permitted unless required by sealant manufacturer.
 8. Closed Cell Polyethylene:
 - a. Non-absorbent to liquid water.
 - b. Use in wall and ceiling joints unless otherwise required by sealant manufacturer.
 9. Reticulated Polymeric: Sof®-Rod, Nomaco, Inc.
 10. Unless otherwise required by sealant manufacturer, oversize rod to be larger than joint width by following minimum amounts:
 - a. Open Cell Polyethylene: 50 percent.
 - b. Closed Cell Polyethylene: 33 percent.
 - c. Reticulated Polymeric: 25 percent.
- D. Elastomeric Tubing Joint Filler:
 1. Neoprene, butyl, EPDM, or silicone tubing compliant with ASTM D1056.
 2. Shore A hardness of 70.
 3. Compatible with sealant, joint substrates, primers, and other sealant backing bond breakers.
 4. Use in pavement joints, unless otherwise required by sealant manufacturer.
 5. Use sealant backing bond breaker tape to separate sealant from rod.

6. Unless otherwise required by sealant manufacturer, oversize rod to be larger than joint width by 25 percent the following minimum amounts:
- E. Sealant Backing Bond Breaker Tape:
 1. Pressure sensitive polyethylene tape or tetrafluorethylene self-adhesive tape required by sealant manufacturer to suit application.
 2. Minimum Thickness of 11 mils.
- F. Masking Tape: Non-staining, non-absorbent material compatible with sealants and surfaces adjacent to joints.
- G. Tooling Liquids: Non-staining material approved by manufacturer to reduce adhesion of sealant to joint finishing tools.
- H. Adhesives shall meet or exceed the VOC and chemical component limits of Cal-GREEN Table 5.504.4.1 Adhesive VOC Limit requirements.
- I. Sealants shall meet or exceed the VOC and chemical component limits of Cal-GREEN Table 5.504.4.2 Sealant VOC Limit requirements.

2.3 MIXES

- A. Comply with manufacturer's instructions.
- B. Mix thoroughly with mechanical mixer without mixing air into sealants.
- C. Continue mixing until sealant is uniform in color and free from streaks of unmixed materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.
- B. Ensure that concrete and masonry have cured minimum of 28 days.
- C. Verify that sealant backing is compatible with sealant.
- D. Verify that substrate surface:
 1. Is within manufacturer's moisture content range.
 2. Complies with manufacturer's cleanliness and surface preparation requirements.
- E. Joint Width:
 1. Verify joints are greater than minimum widths required by manufacturer.
 2. If joints are narrower than minimum required widths, widen narrow joints to indicated width.
 3. Do not place sealant in joints narrower than manufacturer's required minimum.

3.2 PREPARATION

- A. Prepare, clean, and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and matter which might impair adhesion of primer and sealant to substrate.
- C. Remove form release agents, laitance, and chemical retarders, which might impair adhesion of primer and sealant to concrete and masonry surfaces.
- D. Comply with ASTM C1193.
- E. Protect elements adjoining and surrounding work of this Section from damage and disfiguration.
- F. Priming: Prime joint substrates as recommended by manufacturer for actual project conditions, unless priming is not required by:
 1. Apply primer to substrate areas where joint sealant is to adhere.
 2. Comply with manufacturer's sequencing requirements for joint priming and sealant backing bond breaker rod installation to assure required primer application coverage and rate without placement of primer on backer rod surface to be in contact with sealant and avoid three-sided sealant adhesion.
 3. Do not allow spillage and migration of primer onto surfaces not to receive primer.
 4. Install sealant to primed substrates after primer has cured.
- G. Masking Tape:

1. Use masking tape to prevent contact of primer and sealant with adjoining surfaces that would be permanently stained or damaged by:
 - a. Contact with primer and sealant.
 - b. Cleaning methods used to remove primer and sealant smears.
2. Place continuously along joint edges.
3. Apply masking tape so it does not shift in position after placement.

3.3 APPLICATION

A. General:

1. Comply with manufacturer's requirements and instructions.
2. Comply with results and recommendations from:
 - a. "Manufacturer's compatibility and adhesion test" described in Source Quality Control Article.
 - b. "Field hand-pull adhesion test" described in Field Quality Control article.
3. Provide compatible sealant system between dissimilar assemblies and adjacent construction.
4. Seal locations necessary to create and secure continuous air, water, and vapor enclosure even though Contract Documents may not indicate all locations; do not seal weep holes.
5. Seal to prevent migration of water, vapor, and air through joints.
6. Comply with manufacturer's required application temperature and relative humidity ranges. Consult manufacturer when sealant cannot be applied within these ranges.

B. Sealant Backing Bond Breaker:

1. Measure joint dimensions and size materials to achieve manufacturer-required width-to-depth ratios.
2. Install to achieve sealant depth and sealant contact depth no greater than distance required by manufacturer for sealant material, joint width, and joint movement range.
3. Install using blunt instrument to avoid puncturing.
4. Do not:
 - a. Twist, puncture, and tear material.
 - b. Leave gaps between ends of material pieces.
 - c. Stretch or compress material along its length.
 - d. Stretch or compress tape material along its width.
5. Install to provide optimum joint profile and in manner to provide not less than 1/4 inch sealant depth when tooled.
6. Install tape where insufficient joint depth makes use of rod not possible. Match tape width to joint width to prevent three-side adhesion. Do not wrap tape onto sides of the joint.
7. Replace backing bond breaker materials which have become wet with dry materials prior to sealant application.

C. Sealant:

1. Install sealants at same time as installation of backing bond breaker materials.
2. Do not exceed manufacturer's required:
 - a. Material shelf life.
 - b. Material working life.
 - c. Installation time after mixing.
3. Comply with manufacturer's requirements for applying different sealant materials in direct contact with each other.
4. Use gun nozzle size to suit joint size and sealant material.
5. Install sealant with pressure-operated devices to form uniform continuous bead.
6. Use sufficient pressure to fill voids and joints full.
7. Install to adhere to both sides of joint.
8. Install to not adhere to back of joint; provide sealant backing.
9. Install sealant free of air pockets and embedded matter.
10. Recess sealant 1/8 inch from surface of pavements and horizontal surfaces.

D. Sealant Tooling:

1. Comply with manufacturer's tooling method requirements.
2. Tool sealant within manufacturer's tooling time limits.

3. Tooling liquids:
 - a. Comply with manufacturer's requirements regarding use.
 - b. Do not use when not permitted by manufacturer.
 - c. Do not allow tooling liquids to come in contact with surfaces receiving sealant.
 4. Produce smooth exposed surface.
 5. Tool Sealant to be Free of:
 - a. Air pockets and voids.
 - b. Embedded impurities.
 - c. Surface ridges, sags, and indentations.
 6. Achieve full sealant contact and adhesion with substrate.
 7. Form a concave tooled joint shape indicated in Section A of Figure 5 of ASTM C1193, unless otherwise indicated.
 8. Remove excess sealant from surfaces adjacent to joint.
 9. Allow acrylic latex sealant to achieve firm skin before paint is applied.
- E. Masking Tape:
1. Remove immediately after tooling sealant and before sealant skin forms.
 2. Remove without disturbing sealant.

3.4 FIELD QUALITY CONTROL

- A. Field Hand-Pull Adhesion Test:
1. At field sample:
 - a. Before sealant installation is commenced, test materials for indications of staining and poor adhesion to substrate.
 - b. Perform after sealants have fully cured.
 - c. Perform under observation of manufacturer's technical representative.
 2. Subsequent to commencement of sealant installation:
 - a. Perform under observation of manufacturer's technical representative.
 - b. Perform minimum of 4 times prior to completion of sealant installation.
 - c. Schedule tests at evenly-spaced intervals during sealant installation at discretion of sealant manufacturer.
 3. Procedure:
 - a. Make knife cut through sealant from side to side of joint.
 - b. At joint's sides, make two cuts approximately 2 inches long meeting cut made across joint width.
 - c. Place a mark on cut portion of sealant 1 inch from cut across joint width.
 - d. Use fingers to grasp 2 inch piece of sealant firmly between mark and cut across joint width.
 - e. Pull cut portion outward at an angle of 90 degrees from sealant face.
 - f. Use a ruler to measure distance that sealant is pulled.
 - g. Pull uncut sealant out of joint to distance recommended by manufacturer for testing adhesive capability, but not less than a distance equal to maximum movement capability in extension.
 - h. Hold extended sealant for a minimum of 10 seconds.
 - i. If adhesion is proper, sealant should tear cohesively in itself or be difficult to adhesively remove from joint substrate.
 4. Summarize test results in test report. Indicate:
 - a. Sealants tested.
 - b. Joint substrates.
 - c. Cohesive failures.
 - d. Adhesive failures.
 - e. Pull distance used.
 - f. Actions to correct failures and non-complying conditions.
 5. In absence of noncomplying conditions, sealants which do not indicate adhesive failure from testing will be considered satisfactory.
 6. Replace sealant removed from test locations by applying sealant in accordance with manufacturer's requirements for applying sealant to previously sealed joints.

3.5 CLEANING

- A. Clean excess sealants and sealant smears from adjacent surfaces as application progresses; comply with sealant manufacturer's requirements and manufacturer of surface in which joints occur.
- B. Repair or replace defaced or disfigured finishes caused by work of this Section and replace where installation techniques result in unsatisfactory joining of materials and unsightly conditions.

3.6 PROTECTION

- A. Protect sealants from contamination until cured.
- B. Protect sealant joints in horizontal surfaces from foot and vehicular traffic until cured.

3.7 SCHEDULE

- A. Items Not to be Sealed:
 - 1. Joints, perimeter, and penetrations in sound-rated assemblies. Use acoustical sealant specified with sound-rated assembly in Section 092900.
 - 2. Weep holes.
- B. Sealant Schedule:
 - 1. Exterior Locations:
 - a. Wall Joints: Designation S-GP; use primer where required by manufacturer.
 - b. Joints and Perimeter of Penetrations in Horizontal Pedestrian and Vehicle Traffic Surfaces: Designation U-TB.
 - 2. Interior Joints:
 - a. Wall and Ceiling Joints subject to Movement: Designation S-GP.
 - b. Wall and Ceiling Joints not subject to Movement: Designation AL.
 - c. Interior side of exterior openings: S-GP.
 - d. Floor Joints, including tile: Designation U-TB.
 - e. Interior Sanitary Joints; Joints Between Plumbing Fixtures and Adjoining Floor, Wall, and Ceiling Surfaces; Joints Between Back Splashes and Wall Substrates: Designation S-S.

END OF SECTION

SECTION 081100
METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Doors and frames of hollow metal construction.
- B. Related Sections:
 - 1. Section 087100 - Door Hardware.

1.2 SYSTEM DESCRIPTION

- A. General:
 - 1. Meet or exceed ANSI/SDI 250.8 and HMMA 861, and more stringent requirements specified in this Section.
 - 2. Hardware Preparation:
 - a. Comply with ANSI A115 Series and SDI 107, except for hardware locations.
 - b. Comply with Section 087100 for hardware locations.
 - c. Mortise, reinforce, drill, and tap frames and doors at factory to receive mortised and concealed hardware in accordance with templates and approved hardware schedules.
 - d. Reinforce frames and doors for surface mounted hardware; drilling and tapping will be in field at time of hardware application.
 - e. Comply with ANSI/SDI A250.8 and SDI 107 for thickness of hardware reinforcing.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, profiles, and finishes.
 - 2. Include proof that doors and frames are fabricated in accordance with SDI requirements.
- B. Shop Drawings:
 - 1. Submit schedule indicating opening identification number, door and frame types, sheet metal thickness, dimensions, swing, label, hardware requirements, and undercuts when applicable. Use same identification numbers for openings as shown by Contract Drawings.
 - 2. Include elevations and details indicating door and frame types, profiles, conditions at openings, methods of anchoring, hardware locations, reinforcements for hardware, core construction, and provisions for vision panels and louvers when applicable.
 - 3. Clearly identify work that cannot be permanently factory assembled before shipment. Indicate locations of field splice joints and include associated details to ensure proper assembly at project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.
- B. Store in protected dry area under cover.
- C. Place units on wood skids and store in manner that will prevent corrosion and damage.
- D. Avoid use of non-vented plastic or canvas coverings which could trap moisture.
- E. Store assemblies upright, do not stack flat. Provide space between stacked assemblies to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Members of Steel Door Institute (SDI) or Hollow Metal Manufacturer's Association (HMMA).
 - 1. Amweld.
 - 2. Ceco.

3. Curries.
4. Pioneer.
5. Republic.
6. Steelcraft.

2.2 MATERIALS

- A. Maximize use of recycled steel where possible.
- B. Cold-Rolled Steel: ASTM A1008, commercial quality, Class 1, stretcher-leveled, matte finish.
- C. Hot-Rolled Steel: ASTM A1011, commercial quality, pickled, and oiled.
- D. Galvanized / Galvannealed Steel (Exterior and exterior atmosphere Locations):
 1. Sheet: ASTM A653, A60 or G60 coating designation, zinc coated by hot-dip process, commercial quality, stretcher-leveled, mill phosphatized. WCGS not permitted.
 2. Anchors and Accessories: ASTM A879, minimum Class B coating, zinc coated by electro-deposition, commercial quality, mill phosphatized.
- E. Anchor Bolts, Fasteners, and Screws: Manufacturer's standard type, except cadmium or zinc plated finish. Stainless steel also acceptable.
- F. Primer: Manufacturer's standard rust inhibitive primer, air-dried or baked, compatible with finish painting specified in Section 099000.

2.3 FABRICATION

- A. General:
 1. Except where specified or noted otherwise, fabricate frames, door faces and edges using cold-rolled steel. Concealed stiffeners, reinforcing, and other components may be cold-rolled or hot-rolled steel at fabricator's option.
 2. Fabricate frames, doors and related components using galvanized/galvannealed steel where assemblies have exposure to exterior atmosphere.
 3. Fabricate sheet metal work neat in appearance and free from defects, warps, or buckles.
 4. Accurately form metal to required sizes and profiles.
 5. Grind and dress exposed welds smooth and flush with adjacent surfaces.
 6. Remove tool marks and surface imperfections by dressing, filling, and sanding smooth. Do not use metallic filler to conceal manufacturing defects.
- B. Edge Clearances:
 1. Between doors and frames at head and jambs: 1/8 inch.
 2. Between meeting stiles at pairs of doors: 1/8 inch.
 3. Between Bottom Edge of Door and Finish Floor at Non-Label Assemblies: In accordance with HMMA 861, ANSI/SDI A250.8 except where larger undercuts are scheduled. Finish floor is defined as top surface of substrate. Where carpet or other applied surface materials are placed over floor substrate and greater than 1/2 inch thickness, provide 1/4 inch clearance.
 4. Between Bottom Edge of Door and Threshold: 1/4 inch.

2.4 FABRICATION - FRAMES

- A. General Requirements:
 1. Provide frames based on door grade and model in accordance with ANSI/SDI A250.8 and HMMA 820.
 2. Welded construction required; knocked-down not acceptable.
 3. Fully face weld corners, including stops. Grind weld smooth with adjacent surfaces.
 4. Fabricate exterior assemblies of 14 gage or 0.067 inch thick steel.
 5. Fabricate interior assemblies of 16 gage or 0.053 inch thick steel for door openings 4'-0" or less in width, 14 gage or 0.067 inch thick steel for door openings over 4'-0" in width.
 6. Welded construction required; knocked-down not acceptable. Weld joints smooth, full length of joint.
 7. Corners of mitered design; stops coped and butted, or mitered.
 8. Accurately cope joints of mullions, rails, and other similar tubular members; reinforce joints with concealed clips or sleeves.

9. Closed or tubular members may be fabricated of two pieces if interlocked at base of stops; visible seams or joints are not acceptable.
- B. Guard Box:
1. Closed box design, 26 gage or 0.016 inch thick minimum, welded to frame.
 2. Required at mortise hardware cutouts for assemblies installed within masonry walls or where assemblies will have frames grouted with mortar or similar materials at time of installation.
- C. Spreader: Manufacturer's standard temporary channel or angles tack welded at bottom of jamb members.
- D. Floor Anchor Clips:
1. Provide at each jamb and mullions which extend to floor.
 2. In areas where concrete topping or other similar construction occurs, provide adjustable design to permit securing to depressed subfloor construction. In lieu of adjustable design, frames may extend to subfloor.
- E. Jamb Anchors: Comply with SDI-111 and HMMA 820.
1. Metal Stud Wall Systems: Steel clips welded to frame, type or design compatible with stud system. Locate at top of frame, 12 inch from top, and 24 inch centers maximum intermittently, minimum 4 per jamb.
 2. Previously Placed Concrete, Masonry, or Structural Steel: Tension plate and spacer design, welded to frame at approximately 24 inch centers, minimum 3 per jamb. Frames drilled and countersunk for 1/4 inch flathead anchor bolts, set below frame surface.
- F. Silencers:
1. Drill or Punch Frames for Silencers. Coordinate hole size with silencers specified in Section 087100.
 2. Single Interior Doors: 3 at strike jamb.
 3. Pair of Interior Doors: 2 at header.
 4. Weatherstripped doors: None required.

2.5 FABRICATION - DOORS

- A. Flush Doors:
1. Interior Doors: ANSI/SDI Level 2 and Physical Performance Level B, Heavy Duty, Model 1 (1-3/4 inch thick, 18 gage or 0.042 inch thick face sheets, Full Flush Design).
 2. Exterior Doors: ANSI/SDI Level 3 and Physical Performance Level A, Extra Heavy Duty, Model 1, 1-3/4 inch thick; 16 gage or 0.053 inch thick face sheets.
 3. Option: Custom doors complying with NAAMM Standard HMMA 861 "Type A" may be used in lieu of standard doors constructed in accordance with SDI standards.
 4. Core:
 - a. Interior: Resin impregnated kraft paper honeycomb.
 - b. Exterior: Manufacturer's standard insulated core.
 5. Face sheets broken to form and meet in joint on stile edges weld and grind smooth joints on stile edges.
 6. Vertical edges continuously reinforced from top to bottom with steel channels or flat bars placed immediately inside of face sheets.
 7. Reinforce top and bottom edge full width of door with steel channel not less than 16 gage or 0.053 inch thick.
 8. Fabricate exterior doors with top edge closed flush and fabricate bottom edge with flush closure where required for attachment of weatherstripping. Provide openings in bottom closure of exterior doors to permit escape of entrapped moisture.
 9. Provide insulating material in void spaces for sound deadening in assemblies utilizing internal core of steel stiffeners.
 10. Fill face welds and surface depressions with metallic paste filler or body putty, grind smooth and flush to unblemished finish appearance.
 11. Bevel lock or latch edge 1/8 inch in 2 inches at single doors and at meeting stiles at pairs of doors.
- B. Glazing Beads:

1. Minimum 18 gage or 0.042 inch thick steel, screw on type, corners butted or mitered, welded to door assembly on security side, removable on opposite side.
 2. Factory install and secure loose bead with countersunk oval head screws spaced 8 inch centers maximum and within 2 inches of ends.
- C. Astragals:
1. Full height overlapping design, applied on in-active leaf at pairs of interior label doors as necessary to meet label requirements, minimum 20 gage or 0.032 inch thick steel.
 2. Full height overlapping design at pairs of exterior doors, welded on active leaf, 1-3/4 inch by 12 gage or 0.093 inch thick steel.

2.6 FINISHES

- A. Ferrous and Galvanized Steel Assemblies:
1. Clean surfaces free of mil scale, rust, oil, grease, dirt, and other foreign materials.
 2. Phosphatize or chemically treat surfaces before application of prime coat finish.
 3. Touch-up areas where abrasions and welding have destroyed zinc coating with zinc-rich paint before application of prime coat finish.
 4. Prime Coat: Manufacturer's standard rust inhibitive primer to produce smooth and uniform coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.

3.2 INSTALLATION

- A. Install hollow metal assemblies in accordance with SDI 105 and HMMA 840.
- B. Set frames plumb, level, in true alignment, securely fastened to floor with expansion shields and bolts, and fastened to adjoining walls with specified jamb anchors. Remove temporary spreaders and braces.
- C. Fill face of countersunk flathead frame anchors with metallic paste filler; grind smooth and flush with frame surface.
- D. Install doors accurately in frames maintaining specified clearances. Install hardware in accordance with manufacturer's written instructions and associated templates. Refer to Section 087100 for hardware installation requirements.

3.3 ADJUSTMENTS

- A. After installation of hardware, test and adjust doors for smooth operation.

END OF SECTION

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions of Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This Section includes the following, but is not necessarily limited to:
 - 1. Door Hardware, including electric hardware.
 - 2. Thresholds, gasketing and weather-stripping.
 - 3. Door silencers or mutes.
- C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.
 - 1. Division 8: Section – Metal Doors and Frames.

1.3 REFERENCES (Use date of standard in effect as of Bid date.)

- A. 2010 California Building Code, CCR, Title 24.
- B. BHMA - Builders' Hardware Manufacturers Association.
- C. DHI - Door and Hardware Institute.
- D. NFPA - National Fire Protection Association.
 - 1. NFPA 80 - Fire Doors and Other Opening Protectives
 - 2. NFPA 105 - Smoke and Draft Control Door Assemblies
- E. UL - Underwriters Laboratories.
 - 1. UL 10C - Fire Tests of Door Assemblies
 - 2. UL 305 - Panic Hardware
- F. WHI - Warnock Hersey Incorporated
- G. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

- A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.
- B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- C. Submit six (6) copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
 - 1. Include a Cover Sheet with;
 - a. Job Name, location, telephone number.
 - b. Engineer's name, location and telephone number.
 - c. Contractors name, location, telephone number and job number.
 - d. Suppliers name, location, telephone number and job number.

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Door Hardware

087100-1

May 3rd, 2013

Final Construction Documents - Site

04-0120F4

- e. Hardware consultant's name, location and telephone number.
- 2. Job Index information included;
 - a. Numerical door number index including; door number, hardware heading number and page number.
 - b. Complete keying information (referred to DHI hand-book "Keying Systems and Nomenclature"). Provision should be made in the schedule to provide keying information when available; if it is not available at the time the preliminary schedule is submitted.
 - c. Manufacturers' names and abbreviations for all materials.
 - d. Explanation of abbreviations, symbols, and codes used in the schedule.
 - e. Mounting locations for hardware.
 - f. Clarification statements or questions.
 - g. Catalog cuts and manufacturer's technical data and instructions.
- 3. Vertical schedule format sample:

Heading Number 1 (Hardware group or set number – HW -1)					
			(a) 1 Single Door #1 - Exterior from Corridor 101	(b)90°	(c) RH
			(d) 3' 0"x7' 0" x 1-3/4" x (e) 20 Minute (f) WD x HM		
(g) 1	(h)	(i) ea	(j) Hinges - (k) 5BB1HW 4.5 x 4.5 NRP (l) ½ TMS	(m) 626	(n) IVE
2	6AA	1 ea	Lockset - ND50PD x RHO x RH x 10-025 x JTMS	626	SCH

(a) - Single or pair with opening number and location. (b) - Degree of opening (c) - Hand of door(s) (d) - Door and frame dimensions and door thickness. (e) - Label requirements if any. (f) - Door by frame material. (g) - (Optional) Hardware item line #. (h) - Keyset Symbol. (i) - Quantity. (j) - Product description. (k) - Product Number. (l) - Fastenings and other pertinent information. (m) - Hardware finish codes per ANSI A156.18. (n) - Manufacture abbreviation.

- D. Substitution requests must be made prior to bid date and require approval by engineer and/or owner. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.
- F. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- G. Furnish as-built/as-installed schedule with close-out documents, including keying schedule and transcript, wiring/riser diagrams, manufacturers' installation and adjustment and maintenance information.

1.5 QUALITY ASSURANCE

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Engineer, and Contractor, at reasonable times during the course of the Work, for consultation.
 - 1. Responsible for detailing, scheduling and ordering of finish hardware.
 - 2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.

3. Stock parts for products supplied and are capable of repairing and replacing hardware items found defective within warranty periods.
- C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

1.7 WARRANTY

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
 1. Locksets: Seven (7) years.
 2. Electronic Locks: One (1) year.
 3. Closers: Ten (10) years, except electronic closers shall be two (2) years.
 4. Exit devices: Three (3) years.
 5. All other hardware: Two (2) years.

1.8 MAINTENANCE

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

1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference at least one week prior to beginning work of this section.
- B. Attendance: Engineer, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, and Project Inspector.
- C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

	<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
A.	Hinges	Ives	Hager, Stanley, McKinney
B.	Locks, Latches & Cylinders	Schlage	Or Approved Equal
C.	Exit Devices	Von Duprin	Or Approved Equal
D.	Closers	LCN	Or Approved Equal
E.	Push, Pulls & Protection Plates	Ives	Trimco, BBW, DCI
F.	Flush Bolts	Ives	Trimco, BBW, DCI
G.	Dust Proof Strikes	Ives	Trimco, BBW, DCI

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H.	Coordinators	Ives	Trimco, BBW, DCI
I.	Stops	Ives	Trimco, BBW, DCI
J.	Overhead Stops	Glynn-Johnson	Or Approved Equal
K.	Thresholds	National Guard	Pemko, Zero
L.	Seals & Bottoms	National Guard	Pemko, Zero

2.2 MATERIALS

- A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.
- Hinges shall be sized in accordance with the following:
 - Height:
 - Doors up to 41" wide: 4-1/2" inches.
 - Doors 42" to 48" wide: 5 inches.
 - Width: Sufficient to clear frame and trim when door swings 180 degrees.
 - Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
 - Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.
- B. Floor Closers: Shall be equipped with compression springs, cam and roller operating mechanism and a one piece spindle-cam for maximum operating performance and longevity.
- C. Extra Heavy duty Commercial Mortise Locks: Schlage "L" Series as scheduled with "06" Style Lever and "A" Style Rose.
- Locksets to comply with ANSI A156.13, Series 1000, Operational Grade 1 and Security Grade 1 with all standard trims. Locksets shall also comply with UL10C Positive Pressure requirements
 - Lock case shall be manufactured with heavy 12 gauge steel with fully wrapped design. Lock cases with exposed edges are not acceptable. Lock case shall be multi-functional allowing transformation to a different function without opening lock case.
 - Latchbolt shall have 3/4" throw and be non-handed, field reversible without opening the lock case. Solid latchbolts and / or plastic anti-friction devices are not acceptable.
 - The deadbolt, when used, shall be 1" throw stainless steel with a 3/4" internal engagement when fully extended.
 - All trim shall be through-bolted with the spring cages supporting the trim attached to the lock cases to prevent torquing.
 - Levers to have independent rotation in both directions. Exterior lever assembly to be one-piece design attached by threaded bushing. Interior lever assembly shall be attached by screwless shank
 - Thru-bolt lever assemblies through the door for positive interlock. Locks using a through the door spindle for attachment are not acceptable. Spindles shall be independent, designed to "break-away" at a maximum of 75psi torque.
 - Hand of lock chassis to be changeable by simply moving one screw from one side to the case to the other and pulling and reversing the latchbolt.
 - Cylinders to be secured by a cast stainless steel, dual retainer. Locks utilizing screws and / or stamped retainers are not acceptable.
- D. Flush Bolts & Dust Proof Strikes: Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
- Manual flush bolts only permitted on storage or mechanical openings as scheduled.
 - Provide dust proof strikes at openings using bottom bolts.
- E. Door Stops:

1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
 2. Do not install floor stops more than four (4) inches from the face of the wall or partition (CBC Section 1133B.8.6).
 3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- F. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.
- G. Thresholds: As Scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
 2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 "Thermal and Moisture Protection".
 3. Use 1/4" fasteners, red-head flat-head sleeve anchors (SS/FHSL).
 4. Thresholds shall comply with CBC Section 1133B.2.4.1.
- H. Seals: Provide silicone gasket at all rated and exterior doors.
1. Fire-rated Doors, Resilient Seals: UL10C Classified, Category "J" listed seals complying with NFPA 80 & NFPA 252 Standards. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
 2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Category "G" furnish fire-labeled opening assembly complete and in full compliance with NFPA 252. Where required, intumescent seals vary in requirement by door type and door manufacture - careful coordination required.
 3. Smoke & Draft Control Doors, Provide Category "H" listed seals complying with NFPA 105 for use on "S" labeled Positive Pressure door assemblies.
- I. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.
- J. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.3 KEYING

- A. Furnish a masterkey system as directed by the owner or engineer.
- B. A detailed keying schedule is to be prepared by the owner and/or engineer in consultation with a representative of the lock manufacturer. Each keyed cylinder on every keyed lock is to be listed separately showing the door #, key group (in BHMA terminology), cylinder type, finish and location on the door.
- C. Establish a new masterkey system for this project as directed by the keying schedule.
- D. Furnish all cylinders in the Schlage Full Size Interchangable Core (FSIC). Pack change keys independently (PKI)
- E. Furnish construction keying for doors requiring locking during construction.
- F. Furnish mechanical keys as follows:
 - 1. Furnish 2 cut change keys for each different change key code.
 - 2. Furnish 1 uncut key blank for each change key code.
 - 3. Furnish 6 cut masterkeys for each different masterkey set.
 - 4. Furnish 3 uncut key blanks for each masterkey set.
 - 5. Furnish 2 cut control keys cut to the top masterkey for permanent I/C cylinders.
 - 6. Furnish 1 cut control key cut to each SKD combination.
- G. Furnish Schlage Padlocks and the cylinders to tie them into the masterkey system for gates, storage boxes, utility valve security, roof hatches and roll-up doors keyed as directed in the keying schedule.

2.4 FINISHES

- A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.
- B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.
- D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 FASTENERS

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
 - B. Beginning of installation means acceptance of existing conditions.
 - C. Fire-Rated Door Assembly Inspection: Upon completion of the installation, all fire door assemblies shall be inspected to confirm proper operation of the closing device and latching device and that
- IERBYS Temporary Improvements - Site Door Hardware

only the manufacturer's furnished fasteners are used for installation and that it meets all criteria of a fire door assembly per NFPA 80 (Standard for Fire Doors and Other Opening Protectives) 2007 Edition. A written record shall be maintained and transmitted to the Owner to be made available to the Authority Having Jurisdiction (AHJ). The inspection of the swinging fire doors shall be performed by a certified FDAI (Fire Door Assembly Inspector) with knowledge and understanding of the operating components of the type of door being subjected to the inspection. The record shall list each fire door assembly throughout the project and include each door number, an itemized list of hardware set components at each door opening, and each door location in the facility.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 30" and 44" AFF.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.
- G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.
- E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

- A. Conform to CCR, Title 24, Part 2; and ADAAG; and the drawings for access-compliant positioning requirements for the disabled.

3.5 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

SECTION 089100
LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Louvers and related accessories for complete installation.
- B. Related Sections:
 - 1. Section 079200 – Joint Sealants: For sealants installed in perimeter joints between louver frames and adjoining construction.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.
 - 1. AMCA Standard 500-L-99 Laboratory Methods of Testing Louvers for Rating
 - 2. AMCA Publication 501 Application Manual for Louvers
- B. The Aluminum Association Incorporated
 - 1. Aluminum Standards and Data
 - 2. Specifications and Guidelines for Aluminum Structures
- C. American Society of Civil Engineers
 - 1. Minimum Design Loads for Buildings and Other Structures
- D. American Society for Testing and Materials
 - 1. ASTM B209
 - 2. ASTM B211
 - 3. ASTM B221
 - 4. ASTM E90-90
- E. Architectural Aluminum Manufacturers Association
 - 1. AAMA 800 Voluntary Specifications and Test Methods for Sealants
 - 2. AAMA 605.2 Voluntary Specification for High Performance Organic Coatings on Aluminum Extrusions and Panels.
 - 3. AAMA TIR Metal Curtain Wall Fasteners
 - 4. AAMA 2605-98 Superior Performing Organic Coatings on Aluminum Extrusions and Panels

1.3 SUBMITTALS

- A. Product Data
 - 1. Air flow and water entrainment performance test results.
 - 2. Material types and thickness.
- B. Shop Drawings
 - 1. Include elevations, sections and specific details for each louver.
 - 2. Show anchorage details and connections for all component parts.
 - 3. Include signed and sealed structural calculations.
- C. Samples
- D. Submit color chips for approval.

1.4 QUALITY ASSURANCE

- A. Single subcontract responsibility: Subcontract the work to a single firm that has had not less than six years experience in the design and manufacturing of work similar to that shown and required.
- B. Performance Requirements: Provide AMCA and BSRIA test data as required to confirm that the louvers have the specified air and water performance characteristics.

- C. Structural Requirements: Design all materials to withstand wind and snow loads as required by the applicable building code. Maximum allowable deflection for the louver structural members to be $l/180$ or 0.75 inch, whichever is less. Maximum allowable deflection for the louver blades to be $l/120$ or 0.50 inch across the weak axis, whichever is less.
- D. Warranty: Provide written warranty to the owner that all products will be free of defective materials or workmanship for a period of one year from date of installation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: At the time of delivery all materials shall be visually inspected for damage. Any damaged boxes, crates, louver sections, etc. shall be noted on the receiving ticket and immediately reported to the shipping company and the material manufacturer.
- B. Storage:
 - 1. Material may be stored flat, on end or on its side.
 - 2. Material may be stored either indoors or outdoors.
 - 3. If stored outdoors the material must be raised sufficiently off the ground to prevent it being flooded.
 - 4. If stored outdoors the material must be covered with a weather proof flame resistant sheeting or tarpaulin.
- C. Handling:
 - 1. Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.
 - 2. Louver sections may be hoisted by attaching straps to the jambs and lifting the section while it is in a vertical position.
 - 3. Louver sections should only be lifted and carried by the jambs. Heads, sills and blades are not to be used for lifting or hoisting louver sections.

1.6 WARRANTY

- A. Provide written warranty jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from defective materials and workmanship, and agreeing to replace components which fail within 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS / PRODUCTS

- A. Basis of Design: Construction Specailties, Inc, RS-2300, or approved equal.

2.2 LOUVER PROPERTIES

- A. Material: Heads, sills, jambs and mullions to be one-piece structural aluminum members with integral caulking slot and retaining beads. Mullions shall be sliding interlock with integral drains. Blades to be one-piece aluminum extrusions with front lip gutter and multiple secondary gutters designed to catch and direct water to jamb and mullion downspouts. Louvers to be supplied with 4" (101.6mm) high by full depth sill flashings formed from minimum 0.050" (1.27mm) thick aluminum. Sill flashings to have welded side panels. Louvers and sill flashings to be installed in accordance with the manufacturer's recommended procedures to ensure complete water integrity performance of the louver system.
- B. AMCA Performance: A 4' x 4' unit shall conform to the following:
 - 1. Free Area 6.77 sq. ft. (0.63 sq. m.)
 - 2. Intake Pressure drop at 900 fpm free area velocity (274 m/min) 0.51 in. H₂O (12.95 mm)

- C. Wind Driven Rain Performance: The louver test was based on a 39.370"(1.00m) x 39.370" (1.00 m) core area. Unit tested at a rainfall rate of 3.0 inches per hour (75 mm/hr) and with a wind directed to the face of the louver at a velocity 29.1-mph (13 m/s). The test data shall show the water penetration effectiveness rating at each corresponding ventilation rate.

Core Ventilation Rate (m/s):	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5
Core Ventilation Rate (ft/min):	0	106	196	291	391	493	582	667
Free Area Ventilation Rate (ft/min):	0	262	485	720	968	1220	1440	1651
Rating effectiveness:	A	A	A	B	C	D	D	D
Effectiveness Rating:	A = 1 to 0.99		B = 0.989 to 0.95		C = 0.949 to 0.80		D = 0.80 to 0	

2.3 MATERIALS

- A. Aluminum Extrusions: ASTM B211, Alloy 6063-T5, 6063-T6 or 6061-T6.
- B. Aluminum Sheet: ASTM B3209, Alloy 1100, 3003 or 5005.

2.4 FABRICATION

- A. Provide C/S louver models, bird screens, structural supports and accessories as specified and/or shown on the drawings. Materials, sizes, depths, arrangements and material thickness to be as indicated or as required for optimal performance with respect to strength; durability; and uniform appearance.
- B. Louvers to be mechanically assembled using stainless steel or aluminum fasteners.
- C. Include supports, anchorage, and accessories required for complete assembly.

2.5 FINISH

- A. GENERAL: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory. Protect finishes on exposed surfaces prior to shipment. Remove scratches and blemishes from exposed surfaces that will be visible after completing finishing process. Color by engineer.
- B. Two Coat Metallic Fluorocarbon Coating
 - 1. Louvers to be finished with a minimum 1.0 mil (0.025mm) thick full strength 70% resin, 2 coat Fluoropolymer system.
 - 2. All aluminum shall be thoroughly cleaned, etched and given a chromated conversion pretreatment before application of the MICA II coating. The coating shall consist of a primer and a pearlescent pigmented PFV2 topcoat. It shall receive a bake cycle of 17 minutes a 450 deg. F. All finishing procedures shall be one continuous operation in the plant of the manufacturer.
 - 3. Manufacturer to furnish an extended 20 limited warranty for the Kynar/Hylar coating. This limited warranty shall begin on the date of material shipment.

2.6 BIRD SCREEN

- A. Unless otherwise indicated, all louvers to be furnished with mill finish bird or insect screens.
- B. Screens to be 5/8" (15.9mm) mesh, 0.050" (1.27mm) thick expanded and flattened aluminum bird screen secured within 0.055" (1.40mm) thick extruded aluminum frames. Frames to have mitered corners and corner locks.

PART 3 - EXECUTION

3.1 EXAMINATION

IERBYS Temporary Improvements - Site

Louvers

089100-3

May 3rd, 2013

Final Construction Documents - Site

04-0120F4

05/03/13 PERMIT SET

- A. Examine openings to receive the work. Do not proceed until any unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of the work.
- B. Verify dimensions of supporting structure at the site by accurate field measurements so that the work will be accurately designed, fabricated and fitted to the structure.
- C. Anchor louvers to the building substructure as indicated on architectural drawings.
- D. Erection Tolerances:
 - 1. Maximum variation from plane or location shown on the approved shop drawings: 1/8" per 12 feet of length, but not exceeding 1/2" in any total building length or portion thereof (noncumulative).
 - 2. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 3": 1/16" (shop or field joints). This limiting condition shall prevail under both load and no load conditions.
- E. Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.
- F. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.
- G. Set units level, plumb and true to line, with uniform joints.

3.3 PROTECTION

- A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.4 CLEANING

- A. Immediately clean exposed surfaces of the louvers to remove fingerprints and dirt accumulation during the installation process. Do not let soiling remain until the final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to the material finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the engineer, remove damaged materials and replace with new materials.
 - 1. Touch up minor abrasions in finishes with a compatible air-dried coating that matches the color and gloss of the factory applied coating.

END OF SECTION

SECTION 099000
PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Preparation and priming of surfaces scheduled in PART 2 of this section to receive finish coatings.
 2. Painting and finish coating of exterior and interior items and surfaces, including but not limited to:
 - a. Scheduled and otherwise identified exterior surfaces.
 - b. Exposed interior and exterior steel structure, and piping.
 3. Exterior and interior items and surfaces not requiring painting, unless noted otherwise:
 - a. Items with factory applied finishes.
 - b. Moving parts of operating units.
 - c. Code required labels or equipment identification plates.
 - d. Acoustical ceilings.
 4. Field finish coating of shop or factory primed items. Refer to individual Sections for priming requirements.
 5. Finish coatings schedule.
 6. Preparation work and coatings specified in this Section are in addition to shop and factory applied finishes and surface treatment specified in other Sections.
 7. Paint all other items unless specifically indicated not to be painted.

1.2 DEFINITIONS

- A. Conform to PDCA Glossary for interpretation of terms used in this Section except as modified below.
- B. Exposed Surfaces: Surfaces of products, assemblies, and components visible from any angle after final installation. Includes internal surfaces visible when operable doors, panels or drawers are open, and surfaces visible behind registers, grilles, or louvers.
- C. Concealed Surfaces: Surfaces permanently hidden from view in finished construction and which are only visible after removal or disassembly of part or all of product or assembly.
- D. Inaccessible Spaces: Spaces not intended for human use.
- E. Sheen: Degree of luster as measured with specular gloss meter in accordance with ASTM D523:
- | | | |
|-------------|-----------------|----------|
| Flat: | 85 degree meter | Below 15 |
| Eggshell: | 60 degree meter | 5 to 20 |
| Satin: | 60 degree meter | 15 to 35 |
| Semi-gloss: | 60 degree meter | 30 to 65 |
| Gloss: | 60 degree meter | 65 to 80 |
| High Gloss: | 60 degree meter | Over 80 |
- F. System DFT: Dry film thickness of entire coating system unless otherwise noted.

1.3 SYSTEM REQUIREMENTS

- A. Do not walk upon or stage from low roofs to paint walls above. Use bucket trucks to reach over low roofs.
1. Asbestos: Existing corrugated siding and roofing are asbestos bearing materials.
 2. Lead Paint:
 - a. Building dates prior to 1976 and it is assumed lead-based paint has been used on interior and exterior surfaces.
 - b. Do not abrade, sand, or scuff existing painted surfaces.
 - c. Powerwash surfaces to prepare for repainting.
 - d. Special attention is required for repair of rusted surfaces.

- B. Perform testing according to following methods:
 - 1. Solids Content by Volume: ASTM D2832.
 - 2. Surface Burning Characteristics: ASTM E84.
- C. Interface with Adjacent Systems:
 - 1. Review other Sections specifying prime coats to ensure compatibility of total coating system for various substrates.
 - 2. Upon request from other trades, furnish information on characteristics of finish materials proposed for use to ensure compatibility of various coatings.
 - 3. Test compatibility of existing coatings, including shop applied primers and previously applied coatings, by applying specified special coating to small, inconspicuous area.
 - 4. If specified coating lifts or blisters existing coating, apply barrier or tie coat as recommended by coating manufacturer.
 - 5. If no compatible barrier or tie coat exists, remove existing coating completely and apply coating system as specified for new work.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Submit product data, including label analysis for each product proposed for use.
 - 2. Specifically include percent solids-by-volume, volatile organic compound (VOC) content (g/L), and lead content (percent of weight of dried film).
 - 3. Schedule:
 - a. List each material proposed for use, and cross-reference to specific coating system and substrate application.
 - b. Identify each material by manufacturer's catalog number, product name, and generic classification.
 - c. Include typewritten list identifying coating systems and colors applied to each room, space, or item.
- B. Color and Sheen Samples:
 - 1. Prepare 1 sample of each opaque finish coating specified in each color and sheen scheduled for appearance verification.
 - 2. Apply to 12 by 12 by 1/4 inch hardboard. Apply sufficient coating thickness to provide proper hiding and appearance.
 - 3. Label each sample to indicate material, color, and sheen.
- C. Coating System Samples:
 - 1. Prepare 1 sample of each opaque coating system scheduled on actual substrate materials proposed for use. Apply in most common top coat color scheduled.
 - 2. Step back each coat and process at least one inch to show bare substrate and each coat and process in system build-up.
 - 3. Minimum sample size of 4 by 8 inches.
 - 4. Label each sample to indicate materials, color, sheen, DFT of each coat applied, and total system DFT.
- D. Submit following Informational Submittals:
 - 1. Certifications specified in Quality Assurance article.
 - 2. Qualification Data: Applicator's qualification data.
 - 3. Manufacturer's instructions.
- E. Closeout Submittals:
 - 1. Warranty: Submit specified warranty.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Provide products of single manufacturer for use in each coating system.
 - 2. Do not mix products of different manufacturers without approval of engineer and manufacturers involved.
 - 3. Provide manufacturer recommended materials (base and tints) for deep tone colors.

- B. Applicator Qualifications: Company specializing in commercial painting and finishing with 3 years documented experience.
- C. Regulatory Requirements:
 - 1. Comply with CPSC 16 CFR 1303 and other applicable federal, state, and local regulations limiting lead content of coatings to be applied.
- D. Certifications: Submit certification from manufacturer that materials furnished for use on this Project meet or exceed specified requirements and comply with applicable federal, state, and local requirements regarding lead and VOC content.

1.6 FIELD SAMPLES

- A. Sample Installation: Duplicate finishes of approved coating system samples on wall surfaces and other interior and exterior components selected by Engineer.
- B. Provide full-coat finish on at least 100 sq ft of surface until required color, sheen, and texture are obtained. Simulate finished lighting conditions for review of in-place work.
- C. Request review by Engineer of first finished room, space, or item for each coating system for color, texture, quality, and workmanship.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products in accordance manufacturer's instructions.
- B. Deliver products to site in manufacturer's sealed and labeled containers; inspect to verify compliance with specified requirements.
- C. Label containers to indicate manufacturer's name, product name and type of coating, brand code or stock number, date of manufacture, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.
- D. Store coating materials in tightly covered containers in well ventilated area at ambient temperatures of 45 degrees F minimum and 90 degrees F maximum, unless required otherwise by manufacturer. Maintain containers in clean condition, free of foreign materials and residue with labels in legible condition.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.8 PROJECT CONDITIONS

- A. Environmental Conditions: Comply with more restrictive of following or manufacturer's requirements under which systems can be applied.
 - 1. Provide continuous ventilation during application of coatings to exhaust hazardous fumes.
 - 2. Provide heating necessary to maintain surface and ambient temperatures within specified limits.
 - 3. Maintain temperature and humidity conditions for minimum 24 hours before, during, and 48 hours after application of finishes, unless longer times are required by manufacturer.
 - 4. Do not permit wide variations in ambient temperatures which might result in condensation on freshly coated surfaces.
 - 5. Provide illumination of not less than 80 footcandles measured mid-height at substrate surface during application of coatings.
 - 6. Apply water reducible coatings only when ambient and surface temperatures are between 50 degrees F and 90 degrees F.
 - 7. Apply solvent reducible coatings only when ambient and surface temperatures are between 45 degrees F and 90 degrees F.
 - 8. Do not apply coatings under any of following conditions:
 - a. When surfaces are damp or wet.
 - b. During rain, fog, or mist.
 - c. When relative humidity is less than 20 percent or exceeds 85 percent.
 - d. When temperature is less than 5 degrees F above dew point.
 - e. When dust may be generated before coatings have dried.
 - f. In direct sunlight.
 - g. When wind velocity is above 20 mph.

9. Application of coatings may continue during inclement weather provided work areas and surfaces to be coated are enclosed and specified environmental conditions are maintained.

1.9 WARRANTY

- A. Warrant installation to be free from defects in material and workmanship for 5 years.
- B. Repair or replace defects occurring during warranty period.
- C. Defects include but are not limited to pinholes, crazing or cracking, loss of adhesion to substrate, deficient thickness, improper materials and workmanship.

1.10 EXTRA STOCK MATERIAL

- A. Provide 1 unopened gallon container of each type of opaque top coating in each color and sheen used on Project.
- B. Store where directed with labels intact.

PART 2 - PRODUCTS

2.1 COATING MATERIALS - GENERAL

- A. Coatings:
 1. Ready-mixed, factory tinted, best professional grade produced by manufacturer.
 2. Use manufacturer's appropriate base materials to achieve required colors.
 3. Fully grind pigments to maintain soft paste consistency in vehicle.
 4. Capable of being dispersed into uniform, homogeneous mixture.
 5. Possess good flowing and brushing properties.
 6. Capable of drying or curing free of streaks or sags, and yielding specified finish.
 7. VOC content of field applied coatings shall comply with local governing authorities.
- B. Paint Maximum Product Emissions Limits: Top coat and primer interior paints must meet or not exceed the VOC (Volatile Organic Compounds) limits of the current requirements of Green Seal Standards GS-11 - Paints in the building, and Cal-GREEN Table 5.504.4.3 for VOC Content Limits for Architectural Coatings.
- C. Cal-GREEN Requirements for typical paint coatings:
 1. Primers, Sealers, and Undercoaters: 100 grams per liter of product minus water
 2. Flats: 50 grams per liter of product minus water
 3. Non-flats: 100 grams per liter of product minus water
 4. Non-flat High Gloss: 150 grams per liter of product minus water

2.2 FINISH PAINTING SYSTEMS

- A. General: System DFT specified identifies the minimum of the acceptable range.
- B. Exterior Coating Systems:
 1. Corrugated siding and roofing:
 2. System No. EC-1 (Latex Finish):
 - a. Sheen: Eggshell.
 - b. Prime Coat: Alkali Resistant Primer at 1.5 mils.
 - c. Under Coat: Exterior Latex House Paint at 1.5 mils.
 - d. Top Coat: Exterior Latex House Paint at 1.5 mils.
 - e. System DFT: 3.0 mils.
- C. Metal Surfaces:
 1. Paint System No. PT-M2 (Latex Finish):
 - a. Surface: Exterior non-ferrous metals and zinc-coated (galvanized) steel.
 - b. Sheen: Semi-Gloss.
 - c. Prime Coat: Universal Primer at 2.0 mils.
 - d. Under Coat: Premium Acrylic Latex at 1.5 mils.
 - e. Top Coat: Premium Acrylic Latex at 1.5 mils.
 - f. System DFT: 5.0 mils.

2. Paint System No. PT-M4 (Latex Finish):
 - a. Surface: Interior non-ferrous metals and zinc-coated (galvanized) steel.
 - b. Sheen: Semi-Gloss.
 - c. Prime Coat: Universal Primer at 2.0 mils.
 - d. Under Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - e. Top Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - f. System DFT: 4.8 mils
 3. Paint System No. PT-M8 (Latex Finish):
 - a. Surface: Interior ferrous metals - uncoated.
 - b. Sheen: Semi-Gloss.
 - c. Prime Coat: Universal Primer at 3.0 mils.
 - d. Under Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - e. Top Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - f. System DFT: 5.8 mils.
 4. Paint System No. PT-M10 (Latex Finish):
 - a. Surface: Exterior ferrous metals - previously coated.
 - b. Sheen: Semi-Gloss.
 - c. Prime Coat: Touch-up existing with compatible primer.
 - d. Under Coat: Exterior Premium Acrylic Latex Paint at 2.5 mils.
 - e. Top Coat: Exterior Premium Acrylic Latex Paint at 2.5 mils.
 - f. System DFT: 5.0 mils (excluding existing and touch-up primer).
 5. Paint System No. PT-M12 (Latex Finish):
 - a. Surface: Interior ferrous metals - previously coated.
 - b. Sheen: Semi-Gloss.
 - c. Prime Coat: Touch-up existing with compatible primer.
 - d. Under Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - e. Top Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - f. System DFT: 2.8 mils (excluding existing and touch-up primer).
- D. Gypsum Board, MDF Base and Paint Grade Wood Door Surfaces:
1. Paint System No. PT-G5 (Non VOC, Latex/Acrylic Finish):
 - a. Surface: Interior gypsum board walls and ceilings; MDF base, and MDO paint grade wood doors.
 - b. Sheen: Eggshell typical; semi-gloss in bathrooms, restrooms, and other wet areas.
 - c. Prime Coat: Manufacturers standard Non VOC Primer at 1.0 mils.
 - d. Under Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - e. Top Coat: Low-VOC interior latex/acrylic based paint at 1.4 mils.
 - f. System DFT: 3.8 mils.

2.3 PRIMERS

- A. Exterior Cal-GREEN Compliant Alkali Resistant Primer:
 1. Benjamin Moore: Regal Select Primer (546)
 2. Dunn-Edwards: Eff-Stop Primer(ESPR00)
 3. Glidden Professional: Bond Prep Sealer (3030)
 4. Sherwin-Williams: Loxon Masonry Primer (A24W8300)
 5. Vista: Uniprime II Acrylic Masonry Primer (4600)
- B. Universal Metal Primer:
 1. Benjamin Moore: Acrylic Metal Primer (M04)
 2. Dunn-Edwards: Ultra Grip Premium (UGPR00)
 3. Glidden Professional: Devoe Devflex DTM Primer (4020).
 4. Sherwin-Williams: Pro-Industrial Pro-Cryl Universal Primer (B66-310).
 5. Vista: Protec Primer (No. 9600).

- C. Interior Low VOC Latex Primer:
1. Benjamin Moore and Company: Natura Primer (511).
 2. Dunn-Edwards: ENSO Zero VOC Interior Primer (ENSO 00).
 3. Glidden Professional: Lifemaster No VOC Interior Primer (GP 9116).
 4. Sherwin-Williams: Harmony Primer (B11W900)
 5. Vista: Carefree Earth Coat Zero VOC Primer (6000)

2.4 WATER REDUCIBLE PAINTS

- A. Exterior Premium Acrylic Latex House Paint:
1. Benjamin Moore and Company:
 - a. Flat: Regal Select Flat (400)
 - b. Satin: Regal Select Low Luster (401)
 - c. Semi-Gloss: Regal Select Soft Gloss (402)
 - d. Gloss: NA
 2. Dunn-Edwards:
 - a. Flat: Evershield Flat (EVSH10)
 - b. Satin: Evershield Low Sheen (EVSH40-0).
 - c. Semi-Gloss: Evershield Semi Gloss (EVSH50)
 - d. Gloss: Evershield Gloss (EVSH60-0).
 3. Glidden Professional:
 - a. Flat: Fortis 450 Flat (6201).
 - b. Satin: Fortis 450 Satin (6403)
 - c. Semi-Gloss: Fortis 450 Semi-Gloss (6407)
 - d. Gloss: NA
 4. Sherwin-Williams:
 - a. Flat: Duration Flat (K32).
 - b. Satin: Duration (K33).
 - c. Semi-Gloss: Metalatex SG (B42)
 - d. Gloss: Duration (K34)
 5. Vista:
 - a. Flat: Duratone (2000)
 - b. Eggshell: Carefree 100% Acrylic Eggshell (8300)
 - c. Semi-Gloss: Carefree 100% Acrylic Semi Gloss (8400)
 - d. Gloss: Carefree 100% Acrylic Gloss (8500)
- B. Low-VOC Interior Latex/Acrylic Based Paint:
1. Benjamin Moore and Company:
 - a. Flat, Natura Flat (512)
 - b. Eggshell, Natura Eggshell (513)
 - c. Semi-Gloss, Natura Semi-Gloss (514)
 2. Dunn-Edwards:
 - a. Flat: Enso Flat (ENSO 10)
 - b. Eggshell: Enso Eggshell (ENSO 40)
 - c. Semi-Gloss: Enso Semi Gloss (ENSO 50).
 3. Glidden Professional:
 - a. Flat: Lifemaster No VOC Flat (9100).
 - b. Eggshell: Lifemaster No VOC Eggshell (9300).
 - c. Semi-Gloss: Lifemaster No VOC Semi-Gloss (9200).
 4. Sherwin-Williams:
 - a. Flat: Harmony Flat (B5).
 - b. Eggshell: Harmony Eggshell (B9)
 - c. Semi-Gloss: Harmony Semi-Gloss (B10).
 5. Vista:
 - a. Flat: Carefree Earth Coat Zero VOC Flat (6100)
 - b. Eggshell: Carefree Earth Coat Zero VOC Eggshell (6300)
 - c. Semi-Gloss: Carefree Earth Coat Zero VOC Semi-Gloss (6400)

- C. Dry Erase Coating:
 - 1. Basis of Design: Wink by Master Coating Technologies.
 - 2. Idea Paint by Glidden Professional.
 - 3. Color: Clear to show paint color below.

2.5 ACCESSORY MATERIALS

- A. Muriatic acid, mildewcide, TSP (tri-sodium phosphate), acidic-detergent, zinc sulfate, sodium metasilicate, and solvent: Commercially available, non-damaging to surface being cleaned; as specified in PDCA Specification Manual; acceptable to coating manufacturer.
- B. Metal Conditioner: Proprietary phosphoric acid based, etching type solution; acceptable to coating manufacturer.
- C. Rust Inhibitor: Water containing 0.32 percent of sodium nitrite and 1.28 percent by weight of secondary ammonium phosphate (dibasic); or water containing 0.2 percent by weight of chromic acid or sodium chromate or sodium dichromate or potassium dichromate.
- D. Spackling compound, putty, plastic wood filler, liquid de-glosser, latex patching plaster, latex base filler, thinners, and other materials not specifically indicated but required to achieve finishes specified: Pure, of highest commercial quality, compatible with coatings and acceptable to coating manufacturer.
- E. Do not use products of different manufacturers in combination.

2.6 MIXING

- A. Use factory prepared colors matching approved samples. Site tinting will not be permitted.
- B. Thoroughly mix and stir coatings before use to ensure homogeneous dispersion of ingredients. Prior to application, blend multiple containers of same material and color by pouring from one container to another several times to ensure uniform consistency, color, and smoothness.
- C. Mix only in clean mixing pails of material recommended by manufacturer to avoid contamination.
- D. Remove film which may form on surface of material in containers and strain material before using. Stir frequently during use to maintain pigments in suspension. Do not stir film into material.
- E. Apply coatings of consistency recommended by manufacturer. Thin only within recommended limits using thinners approved by coating manufacturer.

2.7 COLORS AND FINISHES

- A. Colors: Refer to Drawings.
- B. Sheen:
 - 1. Ceilings and Walls: Satin/Eggshell elsewhere unless noted otherwise.
 - 2. Ceilings and Walls in Wet Areas: Semi-Gloss, unless noted otherwise.
 - 3. Metal Doors and Frames: Semi-gloss, unless noted otherwise.
 - 4. Metals with accent colors – Semi-gloss, unless noted otherwise.
 - 5. Painted Wood: Semi-gloss, unless noted otherwise.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates and environmental conditions are ready.
- B. Measure moisture content of substrates using recently calibrated electronic moisture meter. Do not apply coatings if moisture content of surfaces exceeds lesser of percentages listed below or those required by coating manufacturer. If excess moisture content exists and cannot be reduced, obtain written approval of coating manufacturer before application of coatings.
 - 1. Common board and dimension lumber: 12 percent; measure with resistance-type meter in accordance with ASTM D4442.
 - 2. Masonry, concrete, CMU, and Portland cement plaster: 17 percent for solvent reduced coatings. Test concrete floors in accordance with ASTM D4263.

- C. Prior to applying alkali and acid sensitive coatings, test surface pH with universal pH paper placed against wetted surface. Substrate pH shall not exceed pH of clean wash water.
- D. Beginning of execution constitutes acceptance of existing conditions.

3.2 PREPARATION - GENERAL

- A. Protect completed construction from damage. Furnish drop cloths, shields, and protective methods to prevent spray, splatter, or droppings from disfiguring other surfaces.
- B. Remove surface hardware, mechanical diffusers, escutcheons, registers, electrical plates, light fixture trim, fittings, fastenings and similar items prior to preparing surfaces for finishing. Provide surface-applied protective masking for non-removable items. Carefully store removed items for reinstallation.
- C. Remove mildew by scrubbing with mildewcide. Rinse thoroughly with clean water.
- D. Before beginning application of coatings, ensure surfaces are clean, dry, and free of dirt, dust, rust or rust scale, oil, grease, mold, mildew, algae, efflorescence, release agents, or any other foreign material which could adversely affect coating adhesion or finished appearance.

3.3 SURFACE PREPARATION FOR NEW WORK

- A. General:
 - 1. Correct minor defects.
 - 2. Remove temporary labels, wrappings, and protective coverings from surfaces to be coated.
 - 3. Seal stains, marks, and other imperfections which may bleed through surface finishes.
- B. Aluminum:
 - 1. Clean in accordance with SSPC SP1 "Solvent Cleaning".
 - 2. Apply etching type primer.
- C. Cloth Insulation Coverings:
 - 1. Remove dirt, grease, oil, and other foreign substances.
 - 2. Seal with thin coating of drywall compound thinned with latex PVA primer to working consistency.
- D. Concrete:
 - 1. Prior to application of coatings, allow surfaces to cure minimum 60 days.
 - 2. Remove dirt, scale, powder, laitance, and bond breakers by light sandblasting to minimum 1.5 mil profile.
 - 3. Remove oil and grease with solution of TSP; rinse well.
 - 4. Remove stains caused by weathering or corroding metals with solution of sodium metasilicate applied after thoroughly wetting surface with potable water; allow to dry.
 - 5. Fill cracks and voids with compatible filler.
- E. Masonry:
 - 1. Prior to application of coatings, allow surfaces to cure minimum 28 days.
 - 2. Remove dirt, scale, loose mortar, efflorescence, and powder by wire brushing or by other approved methods.
 - 3. Remove oil and grease with solution of TSP, rinse, and allow to dry.
 - 4. Remove stains caused by weathering or corroding metals with solution of sodium metasilicate applied after thoroughly wetting surface with potable water; allow to dry.
 - 5. Wash and neutralize surfaces as recommended by coating manufacturer, rinse, and allow to dry.
- F. Steel - Uncoated:
 - 1. Remove weld spatter by chipping or grinding.
 - 2. Clean interior and weather protected steel in accordance with SSPC SP2 "Hand Tool Cleaning" and SP3 "Power Tool Cleaning". Clean areas of excessive corrosion or scale in accordance with SSPC SP7 "Brush-Off Blast Cleaning".
 - 3. Clean exterior steel permanently exposed to elements in accordance with SSPC SP6 "Commercial Blast Cleaning".

4. Apply metal conditioner to bare surfaces in accordance with manufacturer's recommendations, paying particular attention to abrasions, welds, bolts, and nuts. Allow to set as recommended by solution manufacturer. Rinse with clean water with rust inhibitor mixed with water or applied immediately following rinse. Allow to dry.
 5. Prime coat immediately.
- G. Steel - Prime Coated:
1. Remove loose primer and rust to feather-edge at adjacent sound primer by cleaning in accordance with SSPC SP2 "Hand Tool Cleaning" and SP3 "Power Tool Cleaning".
 2. Apply metal conditioner to abrasions, welds, bolts, and nuts in accordance with manufacturer's recommendations. Allow to set as recommended by manufacturer. Rinse with clean water with rust inhibitor mixed with water or applied immediately following rinse. Allow to dry.
 3. Prime coat bare areas immediately.
- H. Galvanized Steel: Remove soluble and insoluble contaminants and corrosion. Sweep (Abrasive) Blasting per ASTM D6386 to achieve a uniform anchor profile (1.0 - 2.0 mils).

3.4 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

- A. General:
1. Remove cracked and deteriorated sealants and caulking.
 2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.
 3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.
 4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.
 5. Remove mildew as specified above.
 6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, request recommendation from engineer.
 7. Apply specified primer to surfaces scheduled to receive coatings.
- B. Concrete, Masonry, and corrugated siding:
1. Fill cracks and voids with latex base filler.
 2. Apply masonry conditioner to masonry surfaces in accordance with manufacturer's instructions.
 3. Apply primer over bare surfaces and filler material.
- C. Metal:
1. Remove rust from surfaces to bare metal in accordance with SSPC SP6 "Commercial Blast Cleaning".
 2. Exercise care not to remove galvanizing.
 3. Complete preparation as specified for new work.

3.5 APPLICATION

- A. General Requirements:
1. Coat all surfaces specified, scheduled, illustrated, and otherwise exposed unless specifically noted otherwise.
 2. Apply coatings of type, color, and sheen as scheduled.
 3. Apply products in accordance with manufacturer's instructions. Use application materials, equipment, and techniques as recommended by coating manufacturer and best suited for substrate and type of material being applied.
 4. Do not apply finishes to surfaces that are improperly prepared.
 5. Number of coats specified are minimum number acceptable.
 6. Apply coating systems to total dry film thickness scheduled. Apply material at not less than manufacturer's recommended spreading rate. Do not exceed maximum single coat thickness recommended by coating manufacturer. Do not double-back with spray equipment building up film thickness of two coats in one pass.
 7. Ensure that edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent of flat surfaces.

8. Finish edges of coatings adjoining other materials or colors sharp and clean, without overlapping.
- B. Prime Coats:
 1. Apply initial coat to surfaces as soon as practical after preparation and before subsequent surface deterioration.
 2. Backprime exterior woodwork with specified primer.
 3. Backprime interior woodwork scheduled to receive transparent finish with gloss varnish reduced 25 percent with mineral spirits.
 4. Apply primer to wood and metal sash before field glazing.
- C. Intermediate and Top Coats:
 1. Allow previously applied coat to dry before next coat is applied.
 2. Sand and dust lightly between coats as recommended by coating manufacturer.
 3. Apply each coat to achieve uniform finish, color, appearance, and coverage free of brush and roller marks, runs, misses, visible laps or shadows, hazing, bubbles, pin holes, or other defects.
 4. If stains, undercoats, or other conditions show through final topcoat, correct defects and apply additional topcoats until coating film is of uniform finish, color, and appearance.
- D. Finish Matching:
 1. Finish closets same as adjoining rooms, unless otherwise specified.
 2. Finish tops, bottoms, and edges of doors same as door faces. Apply sanding sealer to cut-outs. When faces are different colors, finish edges of doors to match space from which they are visible when door is in partly open position.
 3. Finish other surfaces not specifically mentioned to match adjoining surfaces.
- E. Reinstall trim, fittings, and other items removed for finishing.

3.6 FIELD QUALITY CONTROL

- A. Periodically test film thickness of each coat with wet film gage to ensure coatings are being applied to proper thickness.
- B. Request review of each applied coat by engineer before application of successive coats. Only reviewed coats will be considered in determining number of coats applied.
- C. Immediately prior to Substantial Completion, perform detailed inspection of painted surfaces and repair or refinish abraded, stained, or otherwise disfigured surfaces.
- D. Testing: Owner reserves right to employ independent testing agency to verify acceptability of substrates and conformance of coating materials to specified requirements; and to test coating quality and dry film thickness.
- E. If test results show that material does not comply with specified requirements, remove noncomplying coatings, recoat with acceptable material, and pay costs of additional testing to ensure compliance.

3.7 CLEANING

- A. Promptly remove spilled, splashed, or spattered coatings. Clean spots, oil, and other soiling from finished surfaces using cleaning agents and methods which will not damage materials.
- B. If completed construction is damaged beyond normal cleaning or repair by painting operations, replace damaged items at no additional cost to Owner.
- C. Maintain premises and storage areas free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- D. Collect waste, cloths, and material which may constitute fire hazards and place in closed metal containers; remove from site daily along with empty containers.

3.8 PROTECTION

- A. Protect finished work.
- B. Protect work of other trades against damage from coating activities. Correct damage by cleaning, repairing, replacing, and recoating as acceptable to engineer.

- C. Provide "Wet Paint" signs and other methods to protect newly coated surfaces. Remove when directed or when no longer needed.

END OF SECTION

SECTION 101453
TRAFFIC SIGNAGE

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section includes specifications for the Right-of-Way Signage and Roadway Signage, including Object Markers.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM):
1. A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 2. B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 3. D635 Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
 4. D3841 Specification for Glass-Fiber-Reinforced Polyester Plastic Panels
 5. D4956 Specifications for Retroreflective Sheeting
- B. California Manual on Uniform Traffic Control Devices (Federal Highway Administration MUTCD 2009, as amended for use in California) (CMUTCD 2010)
- C. State of California, Department of Transportation (Caltrans), Standard Specifications (2006):
1. Section 56 Signs.
 2. Section 75 Miscellaneous Metals.
 3. Section 82 Markers and Delineators
- D. State of California, Department of Transportation (Caltrans), Standard Plans (2006)

1.03 SYSTEM DESCRIPTION

- A. Signage, unless otherwise noted, shall conform to Caltrans Standard Specifications, Section 56, Signs, and CMUTCD.

1.04 SUBMITTALS

- A. Shop Drawings: Show sizes and thickness of all members, types of materials, methods of construction and assembly, complete sign and framing dimensions including span length and post heights, hangers, brackets, anchorage, relationship to surrounding work by other

trades, shop finishes, sign designs, layouts, lettering (including letter spacing), and other pertinent details of fabrication and installation.

- B. Manufacturer's Data: Submit sign manufacturer's descriptive data.
- C. Samples: Submit samples of all materials under this Section, as follows:
 - 1. Samples of all colors proposed for use on all signs, at least 8 inches by 8 inches.
 - 2. Full-size paper proofs of all signs, marked with proposed colors.
 - 3. After approval of color match and lettering proofs, submit for approval one full size sign of each type, as selected by the Engineer, complete and ready for installation. Submit as many times as necessary until approval by the Engineer has been obtained. Sample sign, upon approval, shall serve as the standard to be equaled by all other work.
 - 4. Submit manufacturer's color palette for fiberglass sign panels and frames for color selection.
- D. Certification of Compliance: Certify that aluminum posts for fiberglass sign panels will withstand 100 mile per hour wind loading. For signs, certify that aluminum posts for aluminum sign panels will withstand 60 mile per hour wind loading.

1.05 QUALITY ASSURANCE

Installation work under this Section shall be performed by experienced sign erectors.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Ship sign panels in such a manner as to ensure their arrival on the job site in an undamaged condition.
- B. Deliver and store material in a manner to prevent cracking, chipping or stress of the components, and to prevent mechanical damage or weather damage.

1.07 WARRANTY

Provide a 5 year warranty against material defects.

PART 2 - PRODUCTS

2.01 SIGN PANELS

- A. Signs shall conform to the provisions in Section 56, Signs, of the Caltrans Standard Specifications and Plans, details shown on the Plans, and these technical provisions.
- B. Roadside sign panels (salvaged) that are damaged shall be replaced at the Contractor's expense. New roadside signs shall consist of reflective sheeting on an aluminum substrate. The reflective sheeting shall conform to the provisions of AASHTO M268 and FHA FP-85 Type II-A and consisting of spherical lens elements adhered to a synthetic resin and enclosed by a flexible, transparent, weatherproof plastic having a smooth outer surface as manufactured by 3M, Seibulite, or Engineer-approved equal. The backing medium shall be synthetic sheet resin or other suitable non-cellulosic material.

- C. Substrate: Sheet aluminum, alloys 6061-T6 or 5052-H38 in accordance with ASTM B209. Thickness: Minimum 1/16 inch. The front and back surfaces of the aluminum base metal shall be cleaned, deoxidized, and coated with a light, tightly adherent chromated conversion coating free of any powdery residue. The base metal pretreatment process shall be in conformance with ASTM B449, Section 5, Recommended Processing Methods. The coating weight shall be calms 2, with a median of 0.1025 oz/ft² as the optimum coating weight.

2.02 NON-ILLUMINATED SIGN PANELS

A. Aluminum Sign Panels:

1. Unless otherwise noted, fabricate sign panels from flat sheet aluminum sheeting conforming to ASTM B209, Alloy 6061-T6, not less than 1/8 inch thick.
2. The sign background shall be reflective sheeting conforming to Federal Specification L-S-300A. The reflective sheeting shall include a pre-coated pressure sensitive adhesive or a tack-free heat activated adhesive either of which shall be applied as specified by the sheeting manufacturer to commended, properly prepared flat surfaces without the necessity of additional adhesive coats on the reflective sheeting or application surface.
3. Application of all lettering, arrows, and other artwork shall be by photographic silk screen. No modification of typefaces or layout rules and the arrow/circle will be permitted without approval by the Engineer.
4. Sign Reflectivity – All signs must comply with the following standards
 - a. The sign face shall have white 3M high intensity prismatic legend (or equal) reflective sheeting (ASTM Type III, IV, X) applied as a background.
 - b. Lettering/graphics shall be one of the following:
 - 1) 3M Scotchlite Electrocut (letter cutting) or equal transparent cuttable film (1170 series) inverse cut to allow white reflective background to show through lettering.
 - 2) Screen printed using 3M 8801 series color translucent ink.
 - 3) Both processes (a or b) will accomplish a color field with white copy.
 - 4) The sign shall include a 3M series 1160 graffiti guard.
5. Street Name Signs on Signal Mast Arms or any aerially mounted signs.
 - a. All sign hardware shall be aluminum and any moving parts shall be stainless steel.
 - b. The sign mounting brackets shall be Sky Bracket with Sign Kit SB-SBK (or Equal).
 - c. Various streets in the City change names at major intersections. Mast Arm Signs that designate different names shall be made with a 30 inch vertical blank by variable with suffix. The name of the roads to the right mounted shown as the street name on top. All legend shall be upper case 8" and lower case 6".
 - d. The sign mounting brackets shall be Sky Bracket with Sign Kit SB-SBK (or Equal).
 - e. Various streets in the City change names at major intersections. Mast Arm

- f. Signs that designate different names shall be made with a 30 inch vertical blank by variable with suffix.
 - g. The name of the roads to the right mounted shown as the street name on top.
 - h. All legends shall be upper case 8" and lower case 6".
6. Corner Street Name signs shall be mounted on top of stop signs when appropriate; otherwise they can be mounted separately.
- a. The U Channel bracket with minimum 12" blade shall be used and mounted on a new or existing square post. At least two holes shall be used to affix the bracket to the post and sign to bracket. A 5/16" x 3/4" bolt shall be used to affix the bracket to the pole. There shall be at least two threaded holes for the set screws to affix the sign to the blade. These set screws shall be a 12 point 5/16-18 x 1/2" as distributed by Simi Fasteners (or Equal). For clarification and guidance, contact traffic operations.
 - b. The corresponding U channel bracket at the intersection shall be mounted with a one piece double bladed positioned perpendicular to each other. Each blade shall include two 5/16-18 threaded hole, spaced at 6inch centers, to accept a 5/16-18x1/2" 12 point faster as distributed by Simi Fasteners (or Equal). The top street name sign shall not show the any holes.

B. Fiberglass Reinforced Plastic Sign Panels:

1. Products: One of the following products and in compliance with the requirements specified herein: Fiber-Brite; Sequentia, "Polyplate"; Intoplast Group "InteCel" (0.5 inch for Post-Mounted CZ Signs, 48 inches or less), or equal.
2. Furnish fiberglass reinforced plastic panel sign in accordance with ASTM D3841. Panel: Acrylic modified and ultraviolet stabilized for outdoor weatherability. Plastic shall contain additives designed to suppress fire ignition and flame propagation. When tested in accordance with the requirements in the ASTM D635, the extent of burning shall not exceed one (1) inch.
3. Plastic shall be stabilized to prevent the release solvents and monomers. The front and back surfaces of the laminate shall be clean and free of constituents and releasing agents that can interfere with the bonding of retroreflective sheeting.
4. Panel shall be weather resistant Grade II thermoset polyester laminate.
5. Color of fiberglass reinforced plastic panels shall be uniform gray.
6. Panels shall be minimum 0.135-inch thick.
7. Tolerances: Finished fiberglass reinforced plastic panel signs shall be flat within a tolerance of $\pm 1/32$ inch per linear foot when measured across the plane of the sign in all directions. The finished signs shall have an overall tolerance within $\pm 1/8$ inch of the specified dimensions.
8. Fabrication: Cut fiberglass reinforced plastic panels from a single piece of laminate. Pre-drill all bolt holes. Fabricate true and smooth predrilled bolt holes, panel edges, and the front and back surfaces of the panels. The panel surfaces shall be free of visible cracks, pinholes, foreign inclusions, warping and wrinkles that can affect performance and serviceability.

2.03 TYPEFACE

- A. Unless otherwise noted, typefaces shall be Helvetica medium with industry standard normal letter spacing.
- B. Street Name Signs (Corner) – Shall have a 9" vertical dimension, length will vary based upon the street name; minimum 24" length to maximum 48" length in 6" increments. The legend shall be white Series "C" with minimum 1/2" spacing. If the street name sign exceeds the 48" maximum length, Series B lettering maybe used. Street name lettering shall be 6" upper case and 4-1/2" lower case and street suffix lettering shall be 3" uppercase. In cases where the length of the street name is too long for a 48" sign plate, lettering may be narrowed to fit with prior City approval. There shall be a 1/2" white border.
- C. Place type and symbols as shown on the Contract Drawings. Bring any design conflict in the manufacture and fabrication of the signage to the attention of the Engineer before proceeding.
- D. Platform signs as indicated in the architectural signage plan.

2.04 SIGN FRAMES

- A. Fabricate required steel framing, sign back bracing and support posts in accordance with Caltrans Standard Specifications, Section 75, Miscellaneous Metal.
- B. Hot-dip galvanize steel framing, mounting components, hardware and appurtenances after fabrication and touch up as specified in Caltrans Standard Specifications, Section 75, Miscellaneous Metal.
- C. Frames for fiberglass sign panels: Extruded aluminum tubing conforming to the manufacturer's requirements for each sign type. Finish shall be satin anodized in color selected by the Engineer.

2.05 FASTENINGS AND ANCHORS

- A. Unless otherwise noted, design a complete system of fastenings and anchorage devices for the various signs, as required for attachment to the various supporting structures.
- B. Straps and Saddle Brackets: Stainless steel conforming to the requirements of ASTM A167, Type 302 or 304, for mounting sign panels on electroliers, sign structure posts, and where shown on the Contract Drawings.
- C. Theft and vandal proof bolts: Stainless steel with a chromium content of at least 16 percent and a nickel content of at least 8 percent.
- D. Lag Screws, Bolts (Except Theft-Proof Bolts), Metal Washers and Nuts: Commercial quality steel, hot dip galvanized after fabrication in accordance with Caltrans Standard Specifications, Section 75, Miscellaneous Metal. Fiber washers shall be of commercial quality.
- E. Fastenings and anchors for fiberglass sign panels shall conform to the sign panel manufacturer's requirements for each sign type.

2.06 SIGN COLORS

- A. Standard paint colors as manufactured by Dupont, or equal, and as follows:

Color	Imron{spray}	Dulux{brush}
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Red	68209UM	93-58209H
Yellow	6808U	93-6808
White	617U	93-21667
Black	69	93-005

- B. For fiberglass sign panels, as selected from manufacturer's color palette.

2.07 POSTS

- A. Metal Posts: Metal posts shall be in accordance with Caltrans Standard Specifications, Section 56-2.02A, Metal Posts, with the following additional requirements:
 - 1. Hot dip galvanize steel posts, mounting components, hardware and appurtenances after fabrication and touch up as specified in in Caltrans Standard Specifications Section 75 - 1.05, Galvanizing.
 - 2. A break away system using Western Highway Ulti Mate with soil stabilizer shall be used as appropriate or equal.
- B. Wood Posts: Wood posts shall be in accordance with Caltrans Standard Specifications, Section 56-2.02B, Wood Posts, with the following additional requirements:
 - 1. Posts shall be 4 x 4 inches nominal size unless otherwise indicated on the Contract Drawings.
 - 2. Preservative treat posts other than all heart redwood. Kiln dry prior to treatment
- C. Aluminum Posts for Fiberglass Sign Panels: Extruded aluminum tubing conforming to the manufacturer's requirements for each sign type. Finish shall be satin anodized. Design posts to withstand 100 mile per hour wind loading.
- D. Object Marker: Type K-1, conforming to the details shown on Caltrans Standard Plan A73A.

PART 3 - EXECUTION

3.01 SIGN INSTALLATION

- A. Roadside signs shall be installed as specified in Section 56-2, Roadside Signs, of the Caltrans Standard Specifications, and these technical provisions, and as indicated on the Plans.
- B. Install signs true, plumb, and level, where shown on the Contract Drawings. Do no field cutting of any sign work. Prevent bending and chipping signs. Exercise extreme care in all handling and stacking of signs to avoid bending or chipping. Replace chipped and bent sign panels. Exact locations of signs will be confirmed by the Engineer in the field.
- C. Rigidly anchor work to the supporting construction, as shown on the approved shop drawings. Conceal fastenings, except those which anchor supporting members to structure. Fabricate and erect supporting members and securely attach to the various structures in accordance with Caltrans Standard Specifications, Section 75, Miscellaneous Metal.
- D. Subsequent to erection, if required by the Engineer, exterior signs may be required to be covered until their actual use is required. Material used to temporarily cover any sign panel shall effectively conceal the message and be non-injurious to the panel, its finish, and its structural integrity.

3.02 POST INSTALLATION

- A. Install posts in accordance with Caltrans Standard Specifications, Section 56-2.03, Construction, with the following additional requirements:
 - 1. The remaining space around the post in the post holes shall be backfilled with concrete.
 - 2. Dispose of surplus excavated material as specified in Section 31 00 00, Earthwork.
 - 3. Repair any spalling, chipping or cracking of concrete structures. Obtain the Engineer's approval of repair method.
 - 4. Unless otherwise noted, do not paint wood posts and blocks.
 - 5. Touch-up galvanized metal as specified in Caltrans Standard Specifications Section 75 - 1.05, Galvanizing.
 - 6. The line between the center of the top of a post and the center of a post at the ground line shall be plumb within a tolerance not to exceed 0.02-foot in 10 feet.

3.03 REMOVING, RELOCATING, REINSTALLING AND SALVAGING EXISTING SIGNS

- A. Remove, relocate, and salvage existing signs in accordance with Section 02 41 00, Demolition, as augmented herein.
- B. Remove and re-install existing signs in new locations as shown on the Contract Drawings. Provide all necessary components required for erecting the existing sign in its new location, including support framing, hardware, post, post holes and concrete. Obtain Engineer's inspection for defects and approval of signs to be relocated prior to re-installation.
- C. Where existing Milepost signs at one-tenth mile intervals need to be removed to facilitate the Contractor's construction operations, remove and reinstall, or remove and replace with new signs. Relocate Milepost signs to a new location if the existing location changes due to new track alignment.
- D. Salvaging of signs shall include removing, disassembling, preparing, marking, bundling, packaging, tagging, hauling and stockpiling. Signs to be salvaged shall not be removed until their use is no longer required as determined by the Engineer. Salvaged materials shall be cleaned of all foreign materials and pressed flat before delivery to the Engineer.

- E. Existing posts, which support signs that are to be salvaged, shall become the property of the Contractor and shall be disposed of outside the work site.
- F. Protection and cleanup requirements for the new signs shall apply to the existing signs once that have been reinstalled.

3.04 PROTECTION AND CLEANING

- A. Protect and maintain completed sign panels in good condition, free from dirt, scratches, hand marks or other blemishes
- B. Clean surfaces of sign work as recommended by the sign manufacturer after installation and keep in a condition satisfactory to the Engineer.
- C. Remove and replace defective work, including that exhibiting cracked, chipped, scratched, abraded, or otherwise damaged finishes, with work conforming to the specified requirements.

3.05 DISSIMILAR MATERIALS

Separate aluminum surfaces in contact with or in close proximity to non-compatible metals or concrete with non-absorptive tape, coat of heavy-bodied bituminous paint, or zinc chromate primer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

- A. Sign installation shall be measured for payment by each sign supplied and installed as shown on the plans or as directed by the Engineer.
- B. Sign relocation shall be measured for payment by each sign removed and installed as shown on the plans or as directed by the Engineer.
- C. Object marker installation shall be measured for payment by each object marker supplied and installed as shown on the plans or as directed by the Engineer.

4.02 PAYMENT

- A. The contract unit price paid for each sign installation shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in traffic signing, completing in place, as shown on the plans or as directed by the Engineer.
- B. The contract unit price paid for each sign relocation shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in traffic signing, completing in place, as shown on the plans or as directed by the Engineer.
- C. The contract unit price paid for each object marker installation shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in installing object markers, complete in place, as shown on the plans or as directed by the Engineer.

END OF SECTION 10 14 53

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**SECTION 129313
BICYCLE RACKS**

PART 1 - GENERAL

1.1 SUMMARY

- A. This Product is a commercially, readily available project
 - 1. Gate style
 - 2. Steel or metal pipe (non-aluminum)
 - 3. Up to 20 stalls each unit
 - 4. Select locally or regionally fabricated products wherever possible.

1.2 SUBMITTALS

- A. General: Submit in accordance with Caltrans Standard Specifications, Section 5, Control of Work.
- B. Manufacturer product cut sheets: Submit product cut sheets. Indicate details necessary for complete fabrication, parts connection and installation, including size, and other necessary information.
 - 1. Furnish manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
 - a. Bicycle Racks.

1.3 COORDINATION

- A. Coordinate with other sections of Specifications to ensure proper scheduling for delivery and installation of Work and to ensure that proper provisions are made for installation of work specified.

PART 2 - PRODUCTS

2.1 BICYCLE RACKS

- A. Type: Metal
 - 1. Modular bicycle storage rack
 - 2. Allows one wheel to be locked per bicycle
 - 3. Each unit may accommodate 10-20 bicycles slots
 - 4. Tubular galv. steel frame
 - 5. Single or double side access
 - 6. Acceptable Products:
 - a. Creative Pipe Inc.
PO Box 2458 Rancho Mirage, CA 92270
Creativepipe.com
 - b. Park It Bike Racks
ParknPool
40 Park Place, Lexington, VA 24450
 - c. FS Industries
FS Industries.com
PO Box 72659
Providence, RE 02907
800-421-0314

2.2 FABRICATION

- A. Fabricate units from continuous pipe without splices
- B. Bends:
 - 1. Bend rails in jigs.
 - 2. Do not damage or distort pipe and maintain cylindrical cross-section of pipe maintained throughout bend.

3. Form bends free from buckles and twists, with finished surfaces smooth.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate drawings, diagrams, templates, instructions, and directions for installation.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's recommendation.
- B. Install bicycle racks at locations indicated on Drawings.
- C. Install racks in straight line, plumb, and level.

3.3 PROTECTION

- A. Protect bicycle racks from damage and defacement until final acceptance. Replace damaged or defaced bicycle racks with new units prior to final acceptance.

END OF SECTION

SECTION 130000
SITE SEATING – WOOD SPOOLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Product is a custom design-build item
 - 1. (10) Wood spools provided by Owner, and manufactured by others
 - 2. Design-build product shall include seat and back

1.2 SUBMITTALS

- A. General: Submit in accordance with Caltrans Standard Specifications, Section 5, Control of Work.
- B. Product Shop Drawings: Submit custom design and fabrication (build) shop drawings for review and approval; indicate details necessary for complete fabrication and installation, including dimensions, connections of parts, and other necessary information to demonstrate product integrity, stability and safety.
- C. Furnish manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
 - Wood Spool Seating

1.3 COORDINATION

- A. Coordinate with other sections of Specifications to ensure proper scheduling for delivery and installation of Work and to ensure that proper provisions are made for installation of work specified.

PART 2 - PRODUCTS

2.1 SITE SEATING

- A. Wood Spools
 - 1. (10) Individual Units
 - 2. Each unit shall accommodate weight for 1 adult person
 - 3. Non-rolling, no permanent fastening to site surfaces
 - 4. All exposed edges shall be sanded
 - 5. Color: unpainted (except for construction touch up finishing and seating)
 - 6. Acceptable products from:
 - a. Walter Craven, Blank and Cables, Inc., www.blank&cables.com, CA Lic 900628
 - b. Paul Disco, Joinery Structures, 2500 Kirkham St., Oakland, CA 94607 (510.251.8889)
 - c. Brandan Adams, BaDesign, 1601 32nd St., Oakland, CA 94608 (510.444.2922)

2.2 FABRICATION

- A. Fabricate units from wood
- B. Seating:
 - 1. Shall be sanded, smooth surfaces and edges
 - 2. New or recycled wood color shall stain to match outer wood frame
 - 3. Designer/manufacturer name plate may be attached, and as approved by Engineer

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate shop drawings, diagrams, templates, instructions, and directions for installation.

3.2 INSTALLATION

- A. Deliver and install in accordance shop drawing and as per Owner.

END OF SECTION

SECTION 205016

UNDERGROUND DUCTWORK AND STRUCTURES FOR FACILITY SERVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Reinforcement steel for ductworks
- B. Conduit
- C. Pre-cast concrete structures
- D. Cast-in-place concrete ductbank and structures
- E. Frames, covers, gratings, steps and sumps
- F. Cover identification

1.02 MEASUREMENT AND PAYMENT

- A. General: Underground ductwork and structures, as specified herein, will not be measured separately for payment but will be paid for as part of the Contract lump sum price for the related item of work in the Bid Schedule of the Bid Form.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C33 Specification for Concrete Aggregates
 - 2. ASTM F512 Specification for Smooth-Wall Poly Vinyl Chloride (PVC) Conduit and Fittings for Underground Installation

1.04 REGULATORY REQUIREMENTS

- A. California Code of Regulations, Title 24, Part 3, California Electrical Code
- B. State of California Public Utilities Commission (Cal. PUC):
 - 1. Cal. PUC G.O. 128 Rules for Construction of Underground Electric Supply and Communications Systems

1.05 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work, for submittal requirements and procedures.

B. Shop Drawings:

1. Submit Shop Drawings for fabrication and installation of pre-cast concrete structures, cast-in-place concrete structures, and concrete-encased underground ductwork, including the following:
 - a. Excavation and shoring plans with required structural calculations;
 - b. Cast-in-place and pre-cast detailed steel reinforcement drawings; and
 - c. Cast-in-place and pre-cast manufacturer's concrete mix designs for structures and colored concrete as indicated.
2. Shop drawing information may be combined on a single drawing if clarity is not thereby impaired.
3. Shop Drawings shall fully demonstrate that the work to be performed and the materials to be provided comply with the provisions of these Specifications.

C. Product Data: Submit the following:

1. Complete materials list of items proposed to be furnished and installed under this Section.
2. Manufacturers' specifications and other data required to demonstrate compliance with these Specifications.
3. Catalog cuts for the following products:
 - a. Conduits.
 - b. Underground duct system, including manholes, pull boxes, handholes, cable junction boxes, and termination boxes.
 - c. Manhole, pull box, and handhole covers and frames.
 - d. Related miscellaneous hardware and metal items for cable trenches and wireways.
 - e. Trench and wireway covers including composition of FRP materials, divider partition panels, method of joining sections, expansion joint mounting, and support details.

D. Certificates of Compliance: Provide for all specified products.

1.06 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the California Electrical Code, and Cal. PUC General Order No. 128. In case of conflict between the California Electrical Code and Cal. PUC G.O. 128, the provisions of Cal. PUC G.O. No. 128 shall govern.

B. Qualification of Manufacturers:

1. Manufacturers of the products specified for work under this Section shall be in the business of manufacturing similar products and shall be able to provide a history of successful production of the specified products.

2. Submit a list of five major projects, where similar products have been supplied, which have been in satisfactory use or operation for the past five years.

C. Notifications and Inspection: Completed facilities shall be approved by the Engineer before installation of cable and equipment. Corrective work required to obtain approval of underground construction and ductwork shall be performed at no additional cost to the District.

1.08 SITE CONDITIONS

- A. Before beginning construction or installation of a section of underground conduit or ductwork, verify that the site is in suitable condition for installing such conduit or ductwork as indicated.
- B. During non-work hours and at locations where installation of conduits and ducts is temporarily suspended or terminated, close ends of ducts with caps or plugs fitted to prevent entry of water or debris. Use caps or plugs designed for that purpose by the conduit manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcement Steel for Ductbanks:
 1. Provide longitudinal reinforcing steel with a minimum total cross sectional area of 0.0018 times the gross area of the ductbank. Maximum spacing of reinforcement bars shall be 18 inches; minimum of one bar in each corner of ductbank.
 2. Provide steel tie bars in the transverse direction enclosing the longitudinal bars; minimum size of No. 3 bars; minimum spacing of 12 inches. Minimum clear concrete cover over reinforcement steel shall be 3 inches where concrete is cast directly against earth, and 1.5 inches where concrete is cast directly against formwork.
 3. Where ductbank enters rigid underground structures, provide reinforcing steel to tie the ductbank to the structure. Provide details indicating method employed to prevent differential settlement from damaging ductbanks.
- B. Conduit: Conform with ASTM F512. Provide PVC conduit, minimum Schedule 40, and all necessary fittings in sizes as indicated. Provide flared bell ends on conduits and ducts entering manholes, handholes, and pull boxes.
- C. Pre-cast Concrete: Provide pre-cast concrete structures in accordance with requirements of Section 33 05 16 - Utility Structures, and as indicated.
 1. Pre-cast concrete electrical boxes, pull boxes, ground rod boxes, manholes, handholes, and vaults shall be provided as indicated. Concrete reinforcement shall be that which is regularly provided in standard products of the manufacturer. Standard manufactured structures that meet project requirements will be acceptable. Provide concrete inserts for mounting cable support brackets as indicated.
 2. Pull box tops shall be flush with sidewalks or curbs or placed 1-1/2 inches above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be provided with two lifting eyes and two hold-down bolts. Each box shall have a suitable opening for a ground rod, and a drainage opening.
- D. Sand: Sand for filler material, where indicated, and for bedding of conduit in utility trenches shall be a clean and graded, washed sand, all passing a No. 4 U.S. sieve, and conforming generally to ASTM C33 for fine aggregate.

- E. Cast-In-Place Concrete for Ductbank Encasements, Manholes, Pull Boxes, and Vaults:
1. Concrete shall be Class 3000 in accordance with Section 03 05 15 - Portland Cement Concrete, for ductbank encasements, manholes, pull boxes, and vaults. Concrete for ductbank encasements shall be colored red as specified in Section 03 05 15 - Portland Cement Concrete.
 2. Formwork and concrete placement shall conform with applicable requirements of Section 03 11 00 - Concrete Forming, and Section 03 30 00 - Cast-in-Place Concrete.
 3. Reinforcing steel, as indicated, shall conform with applicable requirements of Section 03 20 00 - Concrete Reinforcing.
- F. Frames, Covers, Gratings, Steps and Sumps: Provide as indicated and in accordance with Section 33 05 16 - Utility Structures.
- G. Cover Identification: Provide covers with embossed or engraved identification as indicated and as specified in Section 33 05 16 - Utility Structures.

PART 3 - EXECUTION

3.01 EXCAVATION, TRENCHING AND BACKFILLING

- A. Perform excavation, bedding, and backfilling for underground conduits and structures in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities, and as indicated.

3.02 INSTALLATION

- A. Underground Duct System: Install as indicated. Conduit, pull boxes, and manholes shall be located as indicated. Comply with applicable requirements of Cal. PUC G.O. 128.
- B. Ducts:
1. Inspect ducts and couplings to ensure that only clean and undamaged pieces are incorporated in the work.
 2. Ductbanks or conduits shall interface with building construction 5 feet outside of the building and shall have a minimum slope of 3 inches to each 100 feet away from buildings and towards manholes, pull boxes, and handholes, and shall run in straight lines between indicated changes in direction.
 3. Individual conduits that are grouped together to form a ductbank shall conform to the standards and requirements specified herein.
 4. Horizontal or vertical changes in direction exceeding ten degrees shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet, except that manufactured bends may be used at ends of short runs of 100 feet or less, and then only at or within 5 feet of the end of the run. Sweep bends may be made up of curved or straight sections, or combinations thereof. Manufactured bends shall have a minimum radius of 36 inches for ducts of 3 inches in diameter and larger.
 5. Conduits shall terminate in end-bells where duct lines enter vaults.
 6. Spacers or space separators shall be placed not more than 6 feet apart, and shall transmit no vertical load to the conduit.

7. Install ducts, joints, and space separators according to manufacturer's printed instructions and recommendations.
 8. During construction, partially completed duct lines shall be protected from the entrance of debris by means of suitable caps or plugs. As each section of a duct line is completed between manholes, handholes, or pull boxes, a testing mandrel not more than 1/4 inch less than the size of the conduit shall be drawn through each conduit, after which a brush with stiff bristles shall be drawn through until the conduit is clear of particles of earth, sand, or gravel. Conduit caps or plugs shall then be immediately installed.
 9. Construct the concrete-encased ductbank with 3 inch minimum cover on all sides. The concrete used for the ductbank shall be integrally colored with a red mineral coloring pigment as specified in Section 03 05 15 - Portland Cement Concrete.
 10. Install 1/8 inch or larger diameter polypropylene pulling cord in ducts including innerducts. Fasten each cord to pull iron anchorage in pull box, manhole, or vault with 2 feet minimum slack.
 11. Innerduct placement in communications conduits shall be performed to avoid excessive tension and deformation of the innerduct. Damaged or necked down innerduct shall be replaced. Conform with the manufacturer's installation instructions.
 12. Provide metallic numbering tags indicating the conduit number on both ends of all conduit runs.
- C. Pre-cast Concrete Structures: Install pre-cast electrical boxes, pull boxes, handholes, manholes, and vaults as indicated. Boxes shall be placed on 4 inches of compacted sand bedding. Manholes shall be placed on 6 inches of compacted aggregate base as specified in Section 32 11 24 - Aggregate Drainage Layer. Conduit, cable, ground rod entrances, and unused openings shall be sealed with cement mortar.
- D. Cast-In-Place Concrete Structures:
1. The location of each pull box, manhole, and vault shall be approved by the Engineer before construction of such structure is started. Top, walls, and bottom shall consist of reinforced concrete. Walls and bottom shall be of monolithic concrete construction.
 2. Place concrete for pull boxes, manholes, and vaults on well-compacted soil with a minimum of 6 inches of aggregate base as specified in Section 32 11 24 - Aggregate Drainage Layer. Seal all sumps. Frames and covers shall be of gray cast iron. A machine-finished seat shall be provided to ensure a matching joint between the frame and cover.
 3. Where duct lines enter pull boxes, manholes, and vaults, the sections of duct may be either cast in the concrete or may enter through a square or rectangular opening of suitable dimensions provided in the utility structure. A cable-pulling iron anchorage shall be installed in the wall opposite each ductbank entrance.

END OF SECTION 20 50 16

SECTION 224713
OUTDOOR DRINKING FOUNTAIN

PART 1 - GENERAL

1.1 SUMMARY

- A. This Project is a standard manufactured product and commercially available
 - 1. Outdoor
 - 2. Barrier free
 - 3. Single station faucet
 - 4. Non-refrigerated
 - 5. Push button
 - 6. Steel pedestal
 - 7. Select locally or regionally fabricated products wherever possible.
 - 8. Metal and steel components (non aluminum)

1.2 SUBMITTALS

- A. General: Submit in accordance with Caltrans Standard Specifications, Section 5, Control of Work.
- B. Product manufactured cut sheet: Submit manufacturer product cut sheets, indicate details necessary for complete fabrication and installation, including model number, connections of parts, and other necessary information.
- C. Furnish manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
 - Drinking Fountain

1.3 COORDINATION

- A. Coordinate with other sections of Specifications to ensure proper scheduling for delivery and installation of Work and to ensure that proper provisions are made for installation of work specified.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAIN

- A.
 - 1. Outdoor
 - 2. Accessible
 - 3. Pedestal side arm mounted single faucet
 - 4. Steel frame and powder coat finish
 - 5. Color: as per Owner
 - 6. Acceptable Products:
 - a. Haws
Model 33776
 - b. Halsey Taylor
Model 4410
 - c. Kay Park Recreation
Model KP47SHF

2.2 FABRICATION

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate drawings, diagrams, templates, instructions, and directions for installation and operation.
- B. Clean sleeves of debris
- C. Connect plumbing to existing potable water and drainage stub outs

3.2 INSTALLATION

- A. Install in accordance with Health and Safety standards.
- B. Install drinking fountain at location indicated on Drawings.
- C. Provide a minimum 44" clearance from face of building

3.3 PROTECTION

- A. Protect drinking fountain from damage and defacement until final acceptance. Replace damaged or defaced fountain with new unit prior to final acceptance.

END OF SECTION

SECTION 310000

EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Staking and grades
- B. Existing utilities
- C. Earthwork general requirements
- D. Subsurface extraction
- E. Rough grading and filling
- F. Excavation
- G. Embankment construction
- H. Subgrade preparation
- I. Foundation preparation
- J. Subgrade filling/raising grade
- K. Compaction
- L. Backfilling
- M. Finish grading
- N. Field quality control

1.02 RELATED SECTIONS

- A. Section 02 41 00, Demolition
- B. Section 32 11 23, Aggregate Base Course
- C. Section 33 05 28, Trenching and Backfilling for Utilities

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. ASTM C131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 2. ASTM C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
 3. ASTM C535 Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 4. ASTM D422 Method for Particle-Size Analysis of Soils
 5. ASTN D653 Terminology Related to Soil, Rods, and Contained Fluids

6. ASTM D1140 Test Method for Amount of Material in Soils Finer Than the 200 (75-um) Sieve
7. ASTM D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
8. ASTM D2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
9. ASTM D2487 Test Method for Classification of Soils for Engineering Purposes
10. ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
11. ASTM D2974 Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Materials
12. ASTM D3017 Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
13. ASTM D4253 Test Methods for Maximum Index Density of Soils Using a Vibratory Table
14. ASTM D4254 Test Methods for Minimum Index Density of Soils and Calculation of Relative Density
15. ASTM D4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. State of California, Department of Transportation (Caltrans), Standard Test Methods:

1. Calif. Test 217 Method of Test for Sand Equivalent

1.04 DEFINITIONS

- A. Earthwork Terminology: Terms used in this Section and not defined herein shall be interpreted in accordance with the definitions given in ASTM D653.
- B. Soil Classification: Soil classification is based on the Unified Soil Classification system given in ASTM D2487. Group symbols, when used, conform with the symbols of ASTM D2487.
- C. Fill: Soil or soil-rock material placed to raise the subgrade or natural grade of the site.
- D. Backfill: Soil or soil-rock material used to backfill excavations and to backfill excavated spaces around foundation walls, building walls, retaining walls, head walls, and abutments.
- E. Embankment: Soil or soil-rock material for embankment construction. Embankment construction includes constructing embankments and dikes, including the preparation of the areas upon which they are to be placed; and the construction of temporary surcharge embankment above the grading plane.
- F. Borrow: Soil or soil-rock material used for fill, backfill, embankment, or other construction that is excavated from an off-site location and hauled in.
- G. Unsuitable Material: Excavated material or material below the natural ground surface in embankment areas or below sub grade elevation in excavated areas, which is unsuitable for its planned use. Unsuitable material is further defined as material determined to be:

1. Of such unstable nature as to be incapable of being compacted to specified density using ordinary methods at optimum moisture content; or
2. Too wet to be properly compacted and circumstances prevent suitable drying prior to incorporation into the work; or
3. Otherwise unsuitable for the planned use.

The presence of excessive moisture in a material is not, by itself, sufficient cause for determining that the material is unsuitable. The existence of unsuitable material may be indicated in the Contract Documents or may be determined by the Engineer during the progress of the work.

- H. Relative Compaction: The ratio, expressed as a percentage, of the in-place dry density of material as compacted in the field to the maximum dry density of the same material as determined by laboratory test ASTM D1557.
- I. Optimum Moisture Content: The water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.
- J. Relative Density: Mass per unit volume as specified in ASTM D4253 and ASTM D4254, as applicable to the soil and test method employed.

1.05 CLASSIFICATION OF EARTHWORK

- A. For specification purposes, earthwork shall be classified as follows:
1. Excavation-Common: All excavation involved in grading and construction of the trackway, parking areas, landscaped areas, walkways, roads, driveways, and connections thereto; and any other excavation classified or indicated as common excavation. Demolition of the existing concrete and asphalt concrete pavements within the excavation-common prism will be paid separately as indicated elsewhere in this technical specification.
 2. Structure Excavation: The removal of material for the construction of foundations for aerial structures, bridges, buildings, retaining walls, headwalls, cut-and-cover subways, and other structures, and such other excavation indicated as structure excavation.
 3. Structure Backfill: Structure backfill includes furnishing structural fill material, and placing and compacting structural fill material around structures to the lines and grades indicated. Structure backfill includes borrow excavation and material when required.
 4. Pervious Backfill: Includes furnishing, placing, and compacting pervious backfill material behind abutments, wingwalls, and retaining walls, as indicated.
 5. Common Embankment: Used only for embankment construction, above surrounding grade, below 2.5 feet of the finished embankment grade or sub grade, and where there are no foundation-bearing concrete structures above. Common embankment includes borrow excavation material when required.
 6. Select Embankment: Used only for embankment construction, above surrounding grade, within 2.5 feet of the finished embankment grade or sub grade. Select embankment includes borrow excavation material when required.
 7. Subsurface Extraction: Includes removal of abandoned utilities, tanks, walls, foundations, and other miscellaneous subsurface man-made structures that interfere with new construction and are designated to be removed, and the cleaning of such items if they are

indicated to be salvaged. Removal of such obstructions at or above grade is specified in Section 02 41 00, Demolition.

8. Salvaging Topsoil: Salvaging topsoil is the removal of topsoil to the depth indicated, stockpiling the material on-site, and maintaining the stockpile until the material is reused in the work. Salvaging of topsoil shall be classified the same as the excavation with which it is associated, but if no such classification can be made, it shall be classified as Excavation - Common.

1.06 DESCRIPTION

- A. Provide excavation for pavement; excavation and placement of compacted fill and backfill for structures, subsurface and surface drainage; placement of pervious backfill; construction of embankments; sub grade and foundation preparation; subsurface extraction of miscellaneous structures and facilities indicated or required to be removed; and finish grading.

1.07 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Quality Plan: California Department of Transportation (Caltrans), Standard Specifications (2010), Section 11, Quality Control and Assurance general requirements. The Quality Plan shall include a schedule of all tests specified to be performed by the Contractor.
- C. Test Reports: Submit certified test reports of all tests specified to be performed by the Contractor. Test reports shall be sealed and signed by a California registered geotechnical engineer when required to meet requirements of the California Building Code, Chapter 33, and Appendix Chapter 33, and Structural Chapters 18 and 18A.
- D. Samples: Furnish and deliver samples of fill and backfill materials as selected by the Engineer for testing and analysis.
- E. Delivery Tickets: Submit a delivery ticket with each load of imported borrow material delivered to the site, stating the type of fill material and the quantity.
- F. Field Verification for In-Situ Treatment: Submit the proposed program for field verification of Standard Penetration Test "N" Values after in-situ treatment for mitigation of liquefaction potential.

1.08 REGULATORY REQUIREMENTS

- A. Regulatory requirements that govern the work of this Section include the following governing codes:
 1. California Code of Regulations, Title 8, Chapter 4, Subchapter 4 — Construction Safety Orders, and Subchapter 19 — Trench Construction Safety Orders.
 2. California Code of Regulations, Title 24, Part 2, California Building Code, Chapter 33 and Appendix Chapter 33, and Structural Chapters 18 and 18A.

1.09 QUALITY CONTROL

- A. Quality Plan: The Contractor shall submit a Quality Plan, conforming to the requirements of California Department of Transportation (Caltrans), Standard Specifications (2010), Section 11, Quality Control and Assurance, covering all earthwork operations and the field quality control to be performed by the Contractor.

- B. Quality Control: The Contractor shall provide proper quality control measures to assure compliance with specified requirements. Foundation and sub grade preparation and the placement and compaction of fills shall be performed under the surveillance of a California registered geotechnical engineer employed by the Contractor, as required to comply with the California Building Code, Chapter 33 and Appendix Chapter 33 and Chapters 18 and 18A.
- C. Tests: The Contractor shall engage the services of an approved independent soils testing laboratory to perform tests.
- D. Tolerances:
 - 1. Construct finished surfaces to plus or minus 1/2-inch of the elevations indicated.
 - 2. Complete embankment slopes to plus or minus 6 inches of the slope line indicated. Do not encroach on the trackway bed or roadbed.
 - 3. Maintain the moisture content of fill material as it is being placed within plus or minus two percent of the recommended moisture content of the material.

1.10 SITE CONDITIONS

- A. Unfavorable Weather Conditions:
 - 1. Excavating, filling, backfilling, and grading work shall not be performed during weather conditions which might damage or be detrimental to the condition of existing ground, in-progress work, or completed work. When the work is interrupted by rain, excavating, filling, backfilling, and grading work shall not resume until the site and soil condition (moisture content) are suitable for compaction.
 - 2. Sub grade shall be free from mud, snow, ice, and deleterious material when work is resumed.
 - 3. Soil material that is too wet for compaction shall be left to drain, to be aerated and dried by disking and harrowing or other approved methods until the moisture content of the area is uniform and within the specified limits.
- B. Prevention of Erosion: Comply with requirements specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 13, Water Pollution Control, and the following:
 - 1. Prevent erosion of stockpiles, ditches, embankments, filled, backfilled, and graded areas until such time as permanent drainage and erosion control measures have been installed.
 - 2. Perform "protective grading" to provide positive drainage and to minimize ponding of surface water.

PART 2 - PRODUCTS

2.01 FILL AND BACKFILL MATERIALS - GENERAL REQUIREMENTS

- A. Material used for fill, backfill, and embankment construction shall be an inert, inorganic soil, free from deleterious substances and of such quality that it will compact thoroughly without the presence of voids when watered and rolled. (Inorganic soil is defined as soil containing less than two percent by weight of organic material when tested in accordance with ASTM D2974.

Excavated on-site material will be considered suitable for fill, backfill, and embankment construction if it is free from organic matter and other deleterious substances and conforms to the requirements specified herein.

- B. Excavated material that is suitable for fill, backfill, and embankment construction shall be conditioned for reuse and properly stockpiled for later filling and backfilling operations. Conditioning shall consist of spreading material in layers not to exceed 8 inches and raking free of debris and rubble. Rocks exceeding 6 inches in largest dimension and deleterious material shall be removed from the site and disposed of as specified herein under Article 3.03G, Disposal of Surplus Material.
- C. Where conditions require the importing of fill or backfill material, the material shall be an inert soil or soil-rock material free of organic matter and meeting or exceeding the minimum requirements specified herein for the location.
- D. All material to be used for filling, backfilling, and embankment construction requires written approval of the Engineer.

2.02 FILL AND BACKFILL MATERIALS - SPECIFIC REQUIREMENTS

- A. Common Fill: Well-to moderately well-graded soils consisting of sands, silts, and clays, with or without gravel, as excavated, screened or blended, having the following mechanical properties and gradation:

- 1. Gradation (ASTM D422):

Sieve Opening	Percent Passing, by Weight
6-inch square	100
3/4-inch square	70 minimum
- 2. Liquid Limit (ASTM D4318): 50 maximum
- 3. Plasticity Index (ASTM D4318): 25 maximum

- B. Common Embankment: Common fill, with the following additional requirements:

- 1. Liquid Limit (ASTM D4318): 40 maximum
- 2. Plasticity Index (ASTM D4318): 15 maximum

- C. Select Embankment: Well-to moderately-graded soils consisting of sands, silts, and clays, with or without gravel, as excavated, screened or blended, having the following mechanical properties and gradation:

- 1. Gradation (ASTM D422):

Sieve Opening	Percent Passing, by Weight
1 inch square	100
3/8 inch square	75 minimum
U.S. No. 4	20 minimum
U.S. No. 200	35 maximum
- 2. Sand Equivalent (Calif. Test 217): 10 minimum

3. Plasticity Index (ASTM D4318): 10 maximum

2.03 SOURCE QUALITY CONTROL

- A. Fill, backfill, and embankment materials proposed to be used in the work shall be tested in the laboratory for compliance with specified requirements as follows:
1. Moisture-Density Relationship: ASTM D1557.
 2. Moisture Content: ASTM D2216.
 3. Liquid Limit: ASTM D4318.
 4. Plastic Limit and Plasticity Index: ASTM D4318.
 5. Percentage of Wear: ASTM C131 or C535 as applicable.
 6. Sieve Analysis: ASTM D422, and ASTM C136, as applicable.
 7. Percent Passing No. 200 sieve: ASTM D1140.
 8. Sand Equivalent: California Test 217.
 9. Organic Content of Soils: ASTM D2974.
- B. Where classification of soils is necessary to meet specified requirements, perform laboratory tests in accordance with ASTM D2487.
- C. Submit certified test reports of all tests as herein specified under Submittals.
- D. Provide samples as requested by the Engineer for preparing checklists. Provide three samples of each type of material proposed for use from locations selected by the Engineer.

PART 3 - EXECUTION

3.01 STAKING AND GRADES

- A. Lay out the work, establish all necessary markers, bench marks, grading stakes, and other stakes as required, in accordance with the requirements specified in California Department of Transportation (Caltrans), Standard Specifications (2010).

3.02 EXISTING UTILITIES

- A. Verify on site the location and depth (elevation) of all existing utilities and services before performing any excavation work. Refer to Section 33 05 25, Support and Protection of Utilities, for additional requirements. Excavation within 3 feet of an active utility line shall be performed by hand.
- B. Abandoned sewers, piping, and other utilities encountered in the progress of the excavating shall be removed and the ends plugged.
- C. Active utility lines encountered, which are not indicated in the Contract Documents, shall be reported immediately to the Engineer and utility owners involved. The Engineer and utility owners shall be permitted free access to determine the measures deemed necessary to repair, relocate, or remove the utility.

- D Abandoned existing utilities to be removed prior to DSM wall construction, shall be backfilled as indicated in the Contract Plans.

3.03 EARTHWORK GENERAL REQUIREMENTS

- A. Dust Control: Refer to Section 01 57 00, Temporary Controls, for dust control requirements.
- B. Erosion Protection: Prevent erosion of the site at all times. Construct temporary berms and dikes and cut temporary swales to promote natural drainage of site. Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 13, Water Pollution Control I, for additional requirements.
- C. Construction Traffic: Disperse travel paths of traffic and construction equipment over entire width of compacted surfaces so as to aid in obtaining uniform compaction. Protect exposed soil layers with high moisture content from excessive wheel loads.
- D. On-Site Excavation or Borrow Pits: Do not excavate or remove any material from the project site or right-of-way which is not within the designated excavation, as indicated by the slope and grade lines, without written authorization from the Engineer.
- E. Salvaging Topsoil:
 - 1. Salvage topsoil from stripped and excavated areas, and stockpile on the site at appropriate locations. Prevent topsoil from contamination by other materials, and provide adequate drainage and erosion protection.
 - 2. Place stockpiled topsoil in areas to be landscaped as indicated on the Contract Drawings.
- F. Stockpiling of Fill and Backfill Material:
 - 1. Excavate and separately stockpile suitable fill and backfill material, as indicated, during the progress of the excavation work. Save sufficient suitable excavated material, if available, for later filling, backfilling, and embankment construction.
 - 2. Store materials from required excavations that are suitable for fill, backfill, and embankment as excavated, in stockpiles segregated by type.
 - 3. Establish excavated material stockpiles on site only in locations where they will not interfere with the progress of the work. Offsite stockpiling, if necessary, shall be the responsibility of the Contractor.
- G. Disposal of Surplus Material:
 - 1. Excess earth materials, unsuitable materials, and debris shall become the property of the Contractor and shall be removed from the site and disposed of in a legal manner.
 - 2. Location of disposal site and length of haul shall be the Contractor's responsibility.
- H. Maintenance of Excavations, Slopes, and Embankments:
 - 1. Excavate and remove material outside the limits of the excavation which is unstable and constitutes potential slides, and material which comes into excavations for any reason including from the driving of piles.

2. Maintain slopes and embankments until acceptance of the work. Promptly repair slides, slipouts, washouts, settlements, and subsidences that occur for any reason, and refinish the slope or embankment to the indicated lines and grades.
- D. Safeguarding of Structure Walls: Heavy equipment and rollers greater than one ton shall not be operated within 4 feet of structure walls.

3.04 SUBSURFACE EXTRACTION

- A. Remove subsurface facilities and obstructions to the extent indicated.
- B. When subsurface facilities are encountered during excavations which interfere with new construction, and such facilities are not indicated, notify the Engineer promptly for corrective determination.

3.05 ROUGH GRADING AND FILLING

- A. Prior to commencement of earthwork, perform such soil and rock removal and filling as may be required to facilitate the progress of the work and bring all elevations to the rough grading lines indicated on the Contract Drawings. Grading shall be performed by blading or as herein specified under Article 3.08, Subgrade Preparation.
- B. Fill or backfill, test pits, or holes which will not be completely removed by excavation, with lean concrete, pervious backfill, or clean structural fill, and compact as herein specified in layers not exceeding 8 inches in uncompacted thickness.
- C. Fill or backfill holes, swales, and low points that will not otherwise be removed in the course of the work to the indicated grades.

3.06 EXCAVATION

- A. General Excavation Requirements:
 1. Perform excavating as indicated and required for trackway and roadway beds, for concrete footings, foundations, retaining walls, exterior paving, floor slabs, concrete walks, and for site levels and grading, and provide shoring, bracing, underpinning, cribbing, pumping, and planking as required.
 2. Comply with applicable requirements of CCR, Title 8, Trench Construction Safety Orders.
 3. The bottoms of excavations shall be level, firm, undisturbed earth, clean and free from loose material, debris, and foreign matter.
 4. Excavate to the lines and grades indicated on the Contract Drawings.
 5. Excavations shall be supported and maintained by providing structural support of earth walls as specified in Section 31 50 00, Excavation Support and Protection, so that sides are stable and will not move. Excavations may be maintained by sloping cut faces where space permits, if calculations sealed and signed by a civil or structural engineer currently registered in the State of California, show that the slopes are safe. Calculations shall consider all existing conditions, including adjacent traffic, construction loading, and other local effects.

6. Limits of excavations shall allow for adequate working space for installing forms, wall waterproofing, and as required for safety of personnel. Cut excavations in solid rock accurately to the lines indicated on the Contract Drawings, or to the width of the ductbank or concrete encasement.
7. Dewater excavation as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 13, Water Pollution Control. Construct berms around excavations as required to prevent surface water and runoff from entering the excavation.
8. Remove unstable bottom material. Remove large stones, debris, and compressible soils from excavation bottoms to a minimum depth of 12 inches. Where required to excavate to rock, it shall be understood to mean sound bedrock. Remove loose and unsound material.
9. Except as otherwise indicated, preserve the material below and beyond the lines of excavations. Where an excavation is carried below the indicated grade, backfill to the indicated grade as herein specified.
10. Excavations for convenience of the Contractor shall be approved by the Engineer.
11. Place excavated material at a sufficient distance from edge of excavation so as not to cause cave-ins or bank slides, but in no case closer than 3 feet from the edge of excavations.
12. Unauthorized over excavations for footings and foundations shall be filled with lean concrete to indicated elevations.
13. Excavated earth material that is suitable for fill, backfill, or embankment shall be conditioned for re-use and properly stockpiled for later filling and backfilling operations as herein specified. Test, screen, and mix as necessary to meet specified requirements.

3.07 EMBANKMENT CONSTRUCTION

- A. Construct embankments to lines, grades, and contours indicated, in layers as nearly uniform and horizontal as is consistent with the indicated finished contour and profile. Maximum thickness of the layers shall be 8 inches before compaction.
- B. Compact each layer to specified density for entire width of the embankment. Achieve required compaction by rolling with compaction equipment suitable for type and condition of the particular material. Roll in a longitudinal direction parallel to longest dimension, starting at outer edges and progressing toward the center.
- C. Moisture-condition embankment fill material as required to achieve its compaction to the specified density, within the tolerances specified herein.
- D. Do not compact material that contains excessive moisture. In such cases, scarify to the full depth of the layer having excessive moisture content and dry by reworking, mixing with dry materials, or other approved methods.
- E. Remove material that cannot be compacted to required density within specified tolerances, and replace with suitable material.
- F. Where pipes, culverts, or structures extend into embankments, construct embankment to at least 2 feet over and 10 feet on either side of the pipe, culvert, or structure location prior to excavation.

- G. Where fill is to be placed against hillsides or slopes steeper than 5 to 1 (horizontal to vertical), the existing slope shall be benched at least 6 feet horizontally into the hillside as the new embankment is placed in horizontal lifts.
- H. Do not commence final shaping until above specified requirements have been completed. Shape entire surface of the slopes of cuts and embankments to true grade, alignment, and cross section indicated. Leave cut slopes in rock with uniform surface, and remove all loose overhanging rock.

3.08 SUBGRADE PREPARATION

- A. Perform all cutting, blading, and shaping as required to cut and shape the sub grade to the grades and elevations indicated.
- B. Sub grade preparation includes fine grading, reworking as necessary, and preparation of cut, fill, or embankment upon which the structure and equipment foundations, pipe, sub ballast, sub base, base, and pavement will be placed. Remove unsuitable sub grade material, such as weak or compressible soils.
- C. Scarify and mix entire surface of sub grade to a depth of at least 6 inches. Moisture-condition scarified sub grade to 3 percent above optimum moisture content. If sub grade stabilization material is required, incorporate it into the sub grade at this time.
- D. After the material has been thoroughly mixed and moisture-conditioned, accurately construct and fine grade the sub grade to indicated line, grade, and contour with high and low spots eliminated. Compact for full width to the specified density. Remove soft spots developed during working, fill with approved material, and re-compact.
- E. Finish sub grade to straightedge or template within specified tolerances with the finished surface bladed to a uniform, dense, smooth texture.

3.09 FOUNDATION PREPARATION

- A. Complete construction of the excavation support and dewatering systems prior to construction of structure and equipment foundations.
- B. Avoid disturbing bottom of excavation. If bottom is disturbed, restore and stabilize the bearing foundation with compacted pervious backfill material as specified herein.
- C. If material at bottom of the excavation is rock, remove loose material and roughly level the bearing foundation to indicated elevation. If the bottom contains occasional rock outcroppings or rock in only a portion of the area, remove such rock to a depth of 6 inches below indicated sub grade and backfill with lean concrete.
- D. Where unsuitable material is encountered at the elevations indicated for foundations, all soft, loose, or unsuitable material shall be removed. The area shall be scarified to a minimum depth of 12 inches, and the planned elevation shall be re-established by backfilling with structural backfill, moisture-conditioning, and compacting to a minimum dry density of 95 percent of the maximum laboratory dry density as determined in accordance with ASTM D1557. Where the exposed foundation consists of competent, undisturbed in-place soils, scarifying may be omitted.

3.10 SUBGRADE FILLING/RAISING GRADE

- A. Compacted fill for raising of sub grade to indicated elevation shall be constructed by approved methods. Fill material shall be spread in uniform lifts not exceeding 8 inches in uncompacted

thickness. Fill material that does not contain sufficient moisture to compact properly shall be sprinkled with water; if it contains excess moisture it shall be aerated or permitted to dry to the proper water content. Fill material and water shall then be thoroughly mixed before being compacted. Each layer of spread fill material shall be compacted to the specified density.

- B. Control of fill shall consist of field inspection and testing to determine that each layer has been compacted to the required density and to ensure that optimum moisture is being obtained. Any layer or portion of a layer that does not attain the compaction required shall be scarified and re-compacted until the required compaction is obtained.
- C. Spreading and compacting shall be performed as required to produce the required density and a uniform surface smooth and true to grade.

3.11 **COMPACTION**

- A. **Compaction Density:** Compact each layer of embankment, fill, and backfill material to not less than the indicated or specified compaction. Required compactions are defined as Class I, Class II and Class III, as follows:
 - 1. Class I Compaction: 90 percent relative compaction as determined by ASTM D1557.
 - 2. Class II Compaction: 95 percent relative compaction as determined by ASTM D1557.
 - 3. Class III Compaction: 100 percent relative compaction as determined by ASTM D1557
- B. **Required Compactions:**
 - 1. Embankment or Fill where the Surface will be Bearing Foundation: Class II for full depth. Where embankment construction exceeds 5 feet in depth, provide minimum Class I compaction below the top 2.5 feet.
 - 2. Fill Below Trackways and Pavements: Class II for full depth. Where fill exceeds 3 feet in depth, provide minimum Class I compaction below the top 3 feet.
 - 3. Backfill around Structures: Class I under top 12 inches; Class II for top 12 inches.
 - 4. Backfill within 20' of UPRR Structures: Class III compaction within 20' of any bridge abutments, footings or culvert crossings supporting UPRR rail traffic in accordance with Section 31 23 43, Structure Excavation and Backfill.
 - 5. Cut-and-Cover Backfill: Class I to 36 inches above structure or utility; Class II for balance, with a minimum of Class II for top 12 inches.
 - 6. Original Ground or Cut Sub grade: Except as specified in Articles 3.08, Subgrade Preparation and 3.09, Foundation Preparation, where original ground or cut sub grade, or fill less than 1 foot thick, will be sub grade or bearing foundation, scarify the surfaces and provide Class II compaction for at least 8 inches in depth. Include the following additional requirements:
 - a. Provide Class II compaction for original ground when such original ground is within 3.5 feet of top of rail profile or within 2.5 feet of finished pavement grade, for full width of trackway and pavement plus three feet on each side thereof.
 - b. Provide Class II compaction for top 6 inches of undisturbed original ground upon which embankments are to be constructed.

7. Where not otherwise indicated or specified and where structures are not involved, provide 92% relative compaction to minimize settlement. In excavated areas the top 0.5 foot of undisturbed material shall be compacted to 92 percent.

3.12 BACKFILLING

- A. Use materials removed from site excavations if such material meets specified requirements.
- B. Backfilling is required around all substructures. Fill all abandoned vaults, shafts, airways, adits, holes, pits, and other voids.
- C. Place backfill in layers not to exceed eight inches of loose material, and compact each layer to specified density before the next layer is placed.
- D. Place backfill material in such manner that unbalanced horizontal loads will not be applied to a newly placed structure or portion of structure, utility, or pipeline. Do not backfill around portions of structures requiring backfill on only one side or on less than all sides, until the concrete has reached the specified 28-day strength to withstand the earth pressures on structures.
- E. When placing material for backfill around waterproofed structures, protect such structures and the waterproofing thereof with a shield when necessary to prevent displacement or injury by stones or other hard substances in the backfill.
- F. Do not backfill on or against structural concrete until the specified 28-day concrete strength has been attained.
- G. Complete backfill for end bents and abutments, including backfill for wingwalls, in accordance with the above specified time/strength limit. Step slopes behind abutments, unless otherwise indicated, to prevent backfill from acting as a wedge against the abutment. Provide drainage behind abutments and wingwalls as indicated.
- H. Do not use compaction equipment and methods that produce excessive horizontal or vertical earth pressures on structures. Excessive horizontal earth pressures are those in excess of at-rest earth pressures. Excessive vertical earth pressures are those in excess of overburden pressures.
- I. Imported borrow (top soil) within the landscaping area shall conform to Section 32 90 00, Planting and these technical specifications.

3.13 FINISH GRADING

- A. Finish grade all areas to elevations and grades indicated. In areas to receive topsoil and landscape planting, finish grading shall be performed to a uniform 7 to 8 inches below the grades and elevations indicated.
- B. Place and spread stockpiled topsoil to a uniform thickness of 6 inches (approximately) in areas to receive topsoil and landscape planting. Place and spread to a uniform thickness approximately 1 inch below finish grades indicated.

3.14 FIELD QUALITY CONTROL

- A. Regulatory Requirements: In compliance with the California Building Code, Chapter 33 and Appendix Chapter 33, the Contractor's earthwork operations shall be performed under the observance and inspection of a Contractor-employed geotechnical engineer currently registered in the State of California, as follows:

1. Site preparation, cutting and shaping, excavating, filling, backfilling, and embankment construction shall be carried out under the inspection of the geotechnical engineer, who will perform appropriate field and laboratory tests, as determined by the geotechnical engineer, to evaluate the suitability of fill and backfill material, the proper moisture content for compaction, and the degree of compaction achieved. Fill or backfill that does not meet the specified requirements shall be removed or recompacted until the requirements are satisfied.
 2. Cutting and shaping, excavating, conditioning, filling, backfilling, and compacting procedures require approval of the geotechnical engineer as they are successively performed. Work found to be unsatisfactory or work disturbed by subsequent operations before approval is granted shall be corrected in an approved manner as approved by the geotechnical engineer.
- B. Density Tests: Compacted fill, backfill, and embankment shall be tested to verify compliance with specified requirements in accordance with ASTM D2922. Frequency of tests shall be in accordance with the Contractor's Quality Plan, but not less than the following:
1. Expansive Horizontal Areas: One test per 100 cubic yards, or fraction thereof, of fill or backfill placed.
 2. Confined Areas and Embankments: One test per every second lift of fill, backfill, or embankment placed.
- C. Compaction Tests: Tests for compaction shall be performed in accordance with test procedures specified in ASTM D1557, Method D, as applicable. Field-testing of soils or compacted fill in place shall be performed in accordance with applicable requirements of ASTM D2922.
- D. Moisture Content Tests: Compacted fill, backfill, and embankment shall be tested to verify compliance with specified requirements in accordance with ASTM D3017. Minimum frequency of tests shall be as specified above for density tests.
- E.

END OF SECTION 31 00 00

SECTION 311100
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Clearing and grubbing
- B. Tree branches
- C. Demolition/removal
- D. Disposal of removed materials and debris
- E. Salvage
- F. Backfill

1.02 RELATED SECTIONS

- A. State of California, Department of Transportation (Caltrans), Standard Specifications (2006):
 - 1. Section 15 Existing Highway Facilities.
 - 2. Section 16 Clearing and Grubbing.
- B. Dust control is specified in Section 01 57 00, Temporary Controls.
- C. Temporary facilities, such as fences, barricades, warning lights, and other temporary safety measures, are specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work.
- D. Demolition of structures and removal, salvage, or other disposition of slabs, footings and foundations; existing pavement, curbs and gutters, sidewalks, headwalls, walls, and steps; utility service facilities; guardrail and posts, highway and street signs and fences; and other miscellaneous structures and site improvements that interfere with new construction are specified in Section 02 41 00, Demolition.
- E. Removal of items that are buried below grade and salvaging the topsoil is specified in Section 31 00 00, Earthwork.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. The Contractor shall furnish all materials, tools, equipment, facilities, and services as required for performing site clearing, grubbing and other site preparation work.

PART 3 - EXECUTION

3.01 GENERAL

- A. Clearing and grubbing work which interfere with construction or which are directed to be removed by City of Fairfield shall be performed as specified in Section 15, Existing Highway Facilities, and Section 16, Clearing and Grubbing, of the Caltrans Standard Specifications and these technical specifications, or as shown on the Plans, or as directed by City of Fairfield. Coordinate with salvaging of topsoil specified in Section 31 00 00, Earthwork

3.02 CLEARING AND GRUBBING

- A. Clearing and grubbing shall include the removal and disposition of all objectionable material not specified for separate payment elsewhere in these technical specifications, including trees (less than 6 inches in diameter measured 4 feet from the ground), shrubs, other vegetation; and debris and rubbish of any nature.
- B. Do not start earthwork operations in areas where clearing and grubbing are not complete, except that stumps and large roots may be removed concurrently with excavation.
- C. Where the work includes requirements for wood chip mulch, acceptable material from clearing and grubbing activities may be used to produce such mulch.
- D. Tree trimming is not to be performed during Migratory Bird Nesting period.
- E. Remove tree branches overhanging trackways, roadways, and other designated areas of the site to within 20 feet of finish grade. Cut off branches neatly and close to the tree boles. Remove other branches as necessary to present a balanced appearance. Treat scars resulting from tree branch removal with a heavy coat of approved tree paint.
- F. All existing vegetation, outside the areas to be cleared and grubbed, shall be protected from injury or damage resulting from the Contractor's operations.
- G. All activities controlled by the Contractor, except cleanup or other required work, shall be confined within the limits of the areas to be graded.
- H. Nothing herein shall be construed as relieving the Contractor of responsibility for final cleanup.
- I. Stockpiling of items removed in conjunction with clearing and grubbing operations by the Contractor will not be allowed. Contractor shall remove and dispose of all such materials from the site on the same day as the clearing and grubbing operations.

END OF SECTION 31 11 00

SECTION 321123
AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base material.
- B. Installation standards.
- C. Spreading of material.
- D. Compacting.
- E. Field quality control.

1.02 RELATED SECTIONS

- A. Section 32 12 16, Asphalt Paving

1.03 CLASSIFICATION

- A. Aggregate bases are designated as Class 2.

1.04 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
 - 2. ASTM D421 Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants
 - 3. ASTM D1241 Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses
 - 4. ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 5. ASTM D2419 Test Method for Sand Equivalent Value of Soils and Fine Aggregate
 - 6. ASTM D2844 Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils
 - 7. ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - 8. ASTM D3017 Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

- 9. ASTM D3744 Test Method for Aggregate Durability Index
- B. State of California, Department of Transportation (Caltrans), Standard Specifications, 2006 edition:
 - 1. Section 17 Watering
 - 2. Section 26 Aggregate Bases
- C. City of Fairfield Standard Specification and Details.

1.05 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Product Data: Submit source, gradation, R-value, sand equivalent, and durability for the proposed base course material.
- C. Test Reports: Submit plant and field test reports as specified in Articles 2.02, Source Quality Control and 3.05, Field Quality Control, herein.

PART 2 - PRODUCTS

2.01 AGGREGATE BASE MATERIAL

- A. Aggregate for the two classes of aggregate bases at the time the base material is deposited on the prepared sub grade or sub base shall conform with ASTM D1241 and the following requirements:
 - 1. Class 2 Aggregate Base:
 - a. Class 2 aggregate base shall consist of crushed stone or gravel, free from vegetable matter and other deleterious substances. Aggregate shall consist of material of which 90 percent by weight shall be crushed particles. Composition of aggregate base, in percentages by weight, shall conform to one of the following gradings, determined in accordance with ASTM C136:

Percentage Passing Sieves

<u>Sieve Sizes</u>	<u>3/4-inch Maximum</u>
2-inch	-----
1-1/2 inch	-----
1inch	100
3/4-inch	90-100
No. 4	35-55
No. 30	10-30
No. 200	2-9

- b. Class 2 aggregate base shall conform to the following additional requirements:

<u>Tests</u>	<u>ASTM Test</u>	
	<u>Method</u>	<u>Requirements</u>
Resistance (R-Value)	D2844	80 min.
Sand Equivalent	D2419	50 min.
Durability Index	D3744	40 min.

2.02 SOURCE QUALITY CONTROL

- A. The Contractor shall perform sampling and tests of the aggregate base material in accordance with the ASTM Test Methods herein specified, to determine compliance with specified requirements. Samples shall be taken from material as delivered to the site, and shall be prepared in accordance with ASTM D421, as applicable.
- B. Aggregate grading or sand equivalent test shall represent no more than 500 cubic yards of base course material or one days production, whichever is the greater amount.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. The Contractor shall call for an inspection by the Engineer and obtain written acceptance of the prepared sub grade or sub base before proceeding with the placement of aggregate base course.
- B. The sub grade or sub base to receive aggregate base course, immediately prior to spreading, shall conform to the compaction and elevation tolerances indicated for the material involved and shall be free of standing water and loose or extraneous material.

3.02 INSTALLATION STANDARDS

- A. Aggregate base course shall be applied over the prepared sub grade or sub base and compacted in accordance with Section 26, Aggregate Bases, of the Caltrans Standard Specifications May 2006.
- B. Aggregate base course shall have minimum uniform thickness after compaction of dimensions indicated. Where not indicated, compacted thickness shall be 6 inches.
- C. All compaction expressed in percentages in this section refers to the maximum dry density as determined by ASTM D1557 Method D.

3.03 SPREADING OF MATERIAL

- A. Aggregate for base course shall be delivered as uniform mixture of fine and coarse aggregate and shall be spread in layers without segregation.
- B. Aggregate base course material shall be free from pockets of large and fine material. Segregated materials shall be remixed until uniform.

- C. Aggregate base material shall be moisture-conditioned to near optimum moisture content in accordance with the applicable requirements of Section 17, Watering, of the Caltrans Standard Specifications May 2006.
- D. Aggregate base course 6 inches and less in thickness may be spread and compacted in one layer. For thickness greater than 6 inches, the base course aggregate shall be spread and compacted in two or more layers of uniform thickness not greater than 6 inches each.

3.04 COMPACTING

- A. Relative compaction of each layer of compacted aggregate base material shall be not less than 95 percent as determined by ASTM D1557.
- B. Thickness of finished base course shall not vary more than 3/4 inch from the indicated thickness at any point. Base that does not conform to this requirement shall be reshaped or reworked, watered, and recompact to achieve compliance with specified requirements.
- C. The surface of the finished aggregate base course at any point shall not vary more than 3/4 inch above or below the indicated grade.

3.05 FIELD QUALITY CONTROL

- A. The Contractor shall perform field tests in accordance with ASTM D2922 to determine compliance with specified requirements for density and compaction of aggregate base material, and with ASTM D3017 to determine moisture-content compliance of the installed base course.
- B. Testing frequency shall be not less than one test for every 2,000 square feet of base course material, per layer or lift.

END OF SECTION 32 11 23

SECTION 321216

ASPHALT PAVING

PART 1 - GENERAL

1.01.1 SECTION INCLUDES

- A. Placing of base course.
- B. Placing of asphalt concrete.
- C. Sealant.
- D. Field quality control.
- E. Maintenance of pavement.

1.02 RELATED SECTIONS

- A. Preparation of sub grade to proper grade for base course, including compaction, is specified in Section 31 00 00, Earthwork.
- B. Portland cement concrete paving is specified in Section 32 13 13, Concrete Paving.
- C. Aggregate base course for asphalt paving is specified in Section 32 11 23 - Aggregate Base Course.
- D. Painting of stripes and other markings on pavement is specified in Section 32 17 23, Pavement Markings.
- E. Portland cement concrete curbs and gutters are specified in Section 32 16 21, Concrete Curbs, Gutters, Driveways and Walks.

1.03 REFERENCES

- A. State of California, Department of Transportation (Caltrans), Standard Specifications (2006)
 - 1. Section 37 Bituminous Seals
 - 2. Section 39 Asphalt Concrete
 - 3. Section 88 Engineering Fabrics
 - 4. Section 92 Asphalts
 - 5. Section 93 Liquid Asphalts
 - 6. Section 94 Asphaltic Emulsions
- B. State of California, Department of Transportation (Caltrans), Standard Test Methods:
 - 1. Calif. Test 202 Method of Tests for Sieve Analysis of Fine and Coarse Aggregates
 - 2. Calif. Test 375 Method of Determining the In Place Density and Relative Compaction of AC Pavement

3. Calif. Test 379 Method of Determining Asphalt Content of Bituminous Mixtures by Use of the Troxler Nuclear Gauge (Model 3241)
4. Calif. Test 382 Method of Test for Determination of Asphalt and Moisture Contents of Bituminous Mixtures By the Ignition Method

1.04 REGULATORY REQUIREMENTS

- A. Asphaltic products and solvents shall be compliant with the latest regulations of the Bay Area Air Quality Management District regarding regulations governing permissible content of volatile organic compounds (VOC).

1.05 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work, for submittal requirements and procedures.
- B. Mix Design: Submit proposed mix design for each asphaltic concrete mixture and seal coat to be used in the work, covering the specific materials to be used in the mixes. Include test data in support of each proposed mix design.
- C. Test Reports: Submit test results of sampling and testing, and inspection records within 24 hours of asphaltic concrete placement.

1.06 PROTECTION

- A. Protect concrete pavements and walks, curbs and bases, and other improvements adjacent to the operations with suitable materials. The Contractor shall be responsible for any damage caused by the Contractor's employees or equipment and shall make necessary repairs. Buildings and other surfaces shall be covered with paper or other protection, where required. All damage caused by the Contractor's operations shall be repaired or replaced as required.

PART 2 - PRODUCTS

2.01 BASE COURSE MATERIAL

- A. Class 2 Aggregate Base mineral aggregate as specified in Section 32 11 23, Aggregate Base Course, of these Specifications.

2.02 PRIME AND TACK COATS

- A. Prime Coat: Liquid asphalt, slow curing type in conformance with Section 93, Liquid Asphalts, of the Caltrans Standard Specifications.
- B. Tack Coat: Diluted SS-1 or SS-1h emulsion in conformance with Section 94, Asphaltic Emulsions, of the Caltrans Standard Specifications.

2.03 PAVEMENT REINFORCING FABRIC

- A. Pavement reinforcing fabric in conformance with Section 88, Engineering Fabrics, of the Caltrans Standard Specifications.

2.04 ASPHALT PAVING MATERIALS

- A. Paving Asphalt: Steam-refined AR-4000 grade, in accordance with Section 92, Asphalts, of the Caltrans Standard Specifications.
- B. Aggregate: Type A, with the grading of the combined aggregate conforming to 1/2-inch maximum size, medium grading, or 3/4-inch maximum size, medium grading, as indicated, and as specified in Section 39, Asphalt Concrete, of the Caltrans Standard Specifications. For Plaza Asphalt Pavement use 1/2-inch maximum size, medium grading.
- C. Mixing Facilities: Asphalt concrete surfacing material shall be furnished from an approved commercial asphalt central mixing plant.
- D. Asphalt Binder: Asphalt binder used in HMA Type A must be PG 64-10.

2.05 SEAL COAT

- A. Fog seal coat or fine seal coat, as indicated, in conformance with Section 37, Bituminous Seals, of the Caltrans Standard Specifications.

2.06 MIX DESIGN

- A. Design of asphaltic concrete mixes shall be provided by the Contractor, and shall be obtained from a qualified independent testing laboratory or agency, properly equipped to design asphaltic concrete mixes. Costs of obtaining mix designs shall be at the Contractor's expense.
- B. Design of asphaltic concrete mixes, including aggregate quality and gradation, shall conform to the quality requirements of Section 39, Asphalt Concrete, of the Caltrans Standard Specifications.

2.07.1 SOURCE QUALITY CONTROL

- A. The Contractor shall perform sampling and tests of materials in accordance with the following requirements:
 - 1. Aggregate Grading: The combined aggregate, prior to addition of asphalt binder (paving asphalt), shall conform with the Operating Range requirements specified in Section 39, Asphalt Concrete, of the Caltrans Standard Specifications for the type of aggregate specified herein. Conformance with grading requirements shall be determined by California Test 202.
 - 2. Frequency of Tests: Minimum testing frequency shall be one test for every 500 tons, or fraction thereof, for each graded aggregate placed each day.
 - 3. Asphalt Content: Asphalt content shall be within plus or minus 0.50 percent of the mix design content. Conformance with asphalt content requirements shall be determined by California Test 382 or 379 from samples taken from the mat behind the paving machine. Minimum testing frequency shall be one test for every 500 tons, or fraction thereof, for each asphaltic paving mix placed each day.

PART 3 - EXECUTION

3.01 STAGE CONSTRUCTION

- A. Asphalt concrete and asphalt concrete base shall be spread and compacted in layers.

- B. The top layer of asphalt concrete shall not exceed 0.20-foot in compacted thickness. The next lower layer shall not exceed 0.25-foot in compacted thickness, and any lower layers shall not exceed 0.40-foot in compacted thickness.
- C. Each layer of asphalt concrete base shall not exceed 0.40-foot in compacted thickness. No layer shall be placed over a layer which exceeds 0.25-foot in compacted thickness until the temperature at mid depth, of the layer which exceeds 0.25-foot in compacted thickness, is not more than 160°F.

3.02 PLACING OF BASE COURSE

- A. The Contractor shall call for an inspection by the Engineer and obtain written approval of the sub grade before proceeding with the base course.
- B. Base course shall be minimum uniform thickness after compaction of dimensions indicated. Where not indicated, compacted thickness shall be 6 inches for parking stalls and 8 inches for roads, driveways, and aisles of parking areas.
- C. Base course shall be placed over finished sub grade and compacted in accordance with Section 32 11 23, Aggregate Base Course.
- D. After base course has been completed, the Contractor shall call for an inspection by the Engineer and obtain written approval before proceeding with application of the asphalt-wearing surface.

3.03 PLACING ASPHALT CONCRETE

- A. Areas to be paved shall be covered with a layer of hot asphalt concrete surfacing not less than the thickness indicated after compaction. Where not indicated, compacted thickness shall be 2 inches for parking stalls and 2-1/2 inches for roads, driveways, and aisles of parking areas.
- B. Paving asphaltic concrete shall be delivered, laid, rolled, and finished in accordance with the Standard construction process of Section 39, Asphalt Concrete of the Caltrans Standard Specifications.
- C. Before placing asphalt concrete on untreated base, a liquid asphalt prime coat shall be applied to the base course in the areas to be surfaced in accordance with Section 39-4, Subgrade, Prime Coat, Paint Binder (Tack Coat) and Pavement Reinforcing Fabric, of the Caltrans Standard Specifications. Prime coat shall be applied at the rate of 0.25 gallons per square yard.
- D. Pavement reinforcing fabric shall be embedded in the liquid prime coat in accordance with Section 39, Asphalt Concrete, of the Caltrans Standard Specifications.
- E. Before placing asphalt concrete, a tack coat (paint binder) shall be applied to all vertical surfaces against which asphalt concrete surfacing will be placed. Tack coat (paint binder) shall be applied in accordance with Section 39-4, Subgrade, Prime Coat, Paint Binder (Tack Coat) and Pavement Reinforcing Fabric, of the Caltrans Standard Specifications at the rate of from 0.02 to 0.10 gallons per square yard.
- F. Finish surface of the wearing course shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, cold joints, or other irregularities.
- G. Finish paving shall conform to slopes, lines, and finish grades indicated, and shall drain properly. Where adjacent surfaces are intended to be flush (as at concrete gutters, walks, and paving), they shall conform smoothly at all joints.

- H. Ridges, indentations, and other objectionable marks left in the surface of the asphalt concrete by paving or rolling equipment shall be eliminated by rolling. The use of equipment that leaves ridges, indentations, or other objectionable marks in the asphalt concrete shall be discontinued, and other acceptable equipment shall be employed.
- I. Where cold joints are indicated or necessary, cut back the placed and compacted cold asphalt a minimum of 3 inches with a concrete or masonry power saw, so that a vertical face of compacted full thickness material is exposed. Treat this surface with a tack coat before proceeding with the placement of new asphaltic concrete surfacing.
- J. Finish paving shall conform to finish elevations within plus or minus 0.01 of a foot and shall be level to within plus or minus 1/4 inch in 10 feet when measured with a 10-foot straightedge in any direction.
- K. For AC leveling and overlay, plane as necessary to allow a minimum overlay of two inches (0.17'). Finish paving shall conform to slopes, lines, and finish grades indicated on the plans, and shall drain properly. Where adjacent surfaces are intended to be flush such as at concrete gutters, walks, and paving, the AC overlay shall conform smoothly at all joints. Employ gutter/wedge cut techniques along existing curb and gutter to provide flush surface with existing curb and gutter.
- L. A gutter / wedge cut consists of removing the existing asphalt pavement to a depth of two inches (0.17') below the lip of gutter, or to two inches (0.17') below existing grade when gutter cuts are made through old overlays to the face of curb.

The gutter / wedge cut shall daylight 6' from the lip of curb. The line from two inches (0.17') below the existing surface (at the face of the cut) to the daylight shall be a straight line.

1. A wedge cut shall be made straight through a minor street from lip of gutter to lip of gutter or as directed by the Engineer. When the overlay goes straight through a major side street (signalized intersection), a gutter cut will proceed around the return to the E.R. only or as directed by the Engineer. A conform cut shall be made in a similar manner to a gutter cut to allow a good conform to existing asphalt concrete to be left in place.
2. The purpose of gutter / wedge and conform cuts is to allow an exact conform with the lip of gutter or existing pavement and to maintain existing drainage; this conform of line and grade shall be maintained when the overlay is installed in these areas. Extra raking or other work required to fulfill this requirement is hereby specified at no extra cost to the City.
3. Gutter / wedge and conform cuts shall be accomplished by cold planing. The equipment used shall be a type capable of maneuvering close to structures and maintaining a straight line. The asphalt to remain in place shall not be damaged by the Contractor's operation in any way and shall provide a uniform and stable base for resurfacing.

3.04 SEAL COAT

- A. Apply seal coat over finished paving surface in conformance with Section 37, Bituminous Seals, of the Caltrans Standard Specifications.

3.05 FIELD QUALITY CONTROL

- A. The Contractor shall control the quality of the Work and shall provide adequate testing to assure compliance with these Specifications.
- B. After completion of paving work, all paving shall be flooded with water, and any resulting "ponds" shall be ringed with chalk. Such hollows shall be corrected with addition of asphalt paving materials and re-rolling until all paving is completely level and free from hollows and high spots.
- C. The Contractor shall perform in-place density and compaction tests of the completed pavement in accordance with California Test Method No. 375 to determine compliance with specified requirements. Relative compaction shall be 96 percent.

3.06 MAINTENANCE OF PAVEMENT

- A. Upon completion of final rolling, traffic shall not be permitted on the finished pavement for at least six hours, and until the asphalt concrete has cooled sufficiently to withstand traffic without being deformed.
- B. Finished pavement shall be maintained in finished clean condition until the Work is accepted by the Engineer.

END OF SECTION 32 12 16

SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Materials and accessories.
- B. Preparation of subgrade and base.
- C. Formwork.
- D. Placing concrete reinforcement.
- E. Placing concrete.
- F. Joints.
- G. Finishing.
- H. Curing and protection.
- I. Installation of joint seals.
- J. Field quality control.

1.02 RELATED SECTIONS

- A. Preparation of subgrade to proper grade for concrete, including compaction, is specified in Section 31 00 00, Earthwork.
- B. Preparation of base is specified in Section 32 11 23, Aggregate Base Course.
- C. Portland cement concrete curbs and gutters are specified in Section 32 16 21, Concrete Curbs, Gutters, and Walks.
- D. Portland cement concrete, concrete reinforcement, and various materials, services, and incidentals pertaining thereto shall conform to Section 03 20 00, Concrete Reinforcing, Section 03 15 00, Concrete Accessories, Section 03 30 00, Cast-In-Place Concrete, and Section 03 35 00, Concrete Finishing.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. AASHTO M81 Cut-Back Asphalt (Rapid-Curing Type)
- B. American Concrete Institute (ACI):
 - 1. ACI 117 Standard Tolerances for Concrete Construction and Materials
 - 2. ACI 318 Building Code Requirements for Reinforced Concrete
- C. American Society for Testing and Materials (ASTM):

1. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 2. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 3. ASTM A663 Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties
 4. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
 5. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
 6. ASTM C496 Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
 7. ASTM D2628 Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- D. Federal Specifications (FS):
1. UU-B-790 Building Paper, Vegetable Fiber, (Kraft, Waterproofed, Water Repellent, and Fire Resistant)

1.04 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Product Data: Submit the respective manufacturer's product data for manufactured products.
- C. Shop Drawings:
 1. Submit drawings that indicate the locations of all joints in concrete, including construction joints, expansion joints, isolation joints, and weakened-plane or contraction joints.
 2. Submit drawings of reinforcing steel, tie bars, and connecting dowels. Comply with requirements specified in Section 03 20 00, Concrete Reinforcing.

1.05 QUALITY ASSURANCE

- A. Tolerances: Comply with requirements of ACI 117, Section on Pavements.

PART 2 - PRODUCTS

2.01 FORMS

- A. Provide metal forms, weighing not less than 18 pounds per linear foot for pavement 8 inches thick, not less than 20 pounds per linear foot for pavement 9 inches thick, and not less than 22 pounds per linear foot for pavement 10 inches thick, and in no case less than 7/32 inch thick.
- B. Provide side forms having a depth equal to the prescribed edge thickness of the pavement, without horizontal joints.

- C. Provide forms having a base not less than 8 inches wide and a flanged tread or top surface not less than 2 inches wide. For multiple lanes, provide base width at least equal to height.
- D. Provide forms not less than 10 feet long except where shorter forms are necessary for curves. Use metal keyway forms for the full length of roadway form to which attached. Provide wood bulkheads for the full width of pavement lane equipped with keyway form.
- E. Provide holes for bars and dowel assemblies where required.
- F. Provide at least three stake pockets to accommodate a 1 inch diameter stake in each section of form 10 feet or more in length, and at least two such pockets in each section of form less than 10 feet long.
- G. Provide each section of form with a positive locking device that will secure it tightly to the adjoining section.
- H. Provide forms free from warp and of sufficient strength to resist, without visible springing or settlement, all loads applied in the paving process.

2.02 MATERIALS AND ACCESSORIES

- A. Concrete Reinforcement: Refer to Section 03 20 00, Concrete Reinforcing, for requirements.
- B. Portland Cement Concrete: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete, for requirements. Provide class of concrete as indicated on the Contract Drawings.
- C. Liquid Asphalt: AASHTO M81, cut-back asphalt, rapid-curing type.
- D. Subgrade Paper: Kraft laminated building paper with bituminous binder, reinforced, meeting requirements of FS UU-B-790.
- E. Benches and Chairs: ACI 318.
- F. Tie Bars: ASTM A615, Grade 60, of type and size indicated.
- G. Dowels: Plain round bars meeting requirements of ASTM A615, Grade 60, or ASTM A663, Grade 80, epoxy-coated bars, furnished with approved snug-fitting ASTM A53 galvanized pipe sleeve. Provide sleeve with one end closed.
- H. Expansion-Joint Filler: ASTM D2628, preformed elastomeric joint seal.
- I. Joint Sealing Compound: Refer to Section 03 15 00, Concrete Accessories, for requirements.
- J. Concrete Curing Compound: ASTM C309, Type 1.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE AND BASE

- A. Immediately prior to placing forms, condition and trim subgrade and base to exact shape, grade, and cross section required by the Contract Drawings. Condition and shape to indicated width between side forms plus not less than one extra foot on each side.
- B. Use of a subgrade machine of approved type is permitted, in which case place forms in advance of exact conditioning and trimming, to permit use of the machine.

- C. Where the crown is to be warped or sloped to conform to contour of intersecting streets, storm water inlets, and other intersecting contoured surfaces, shape subgrade to required depth and cross section by means of hand tools and other equipment as approved by the Engineer. In addition:
 - 1. Drive grade stakes to proper elevation in the subgrade at 6-foot intervals in both directions.
 - 2. Compact subgrade by rolling at least 1 foot wider on each side than the concrete.
 - 3. Finish concrete in such locations by means of floats, shovels, spades, or other approved hand tools, operated so as to consolidate the concrete without segregation.
- D. Deposit any excess material obtained from such preparations upon adjacent shoulders or as required.
- E. Prepare base, if required, as specified in Section 32 11 23, Aggregate Base Course.

3.02 FORMWORK

- A. Obtain written approval from the Engineer of the subgrade and base prior to placing forms and impervious compacted subgrade.
- B. Place subgrade paper where indicated.
- C. Do not use built-up forms. Remove forms with battered top surfaces, distorted faces or bases, and forms that are deformed or broken in any way; and, if straightened and repaired, do not reuse until they have been inspected and approved in writing by the Engineer.
- D. Do not use forms showing a variation of more than 1/8 inch in a 10-foot length from the plane of the top or face when tested with a straightedge.
- E. Join forms neatly and tightly and stake securely with stakes in every pocket. Drive up fully all locking devices at form joints so as to produce a smooth fitting, rigid joint.
- F. Maintain proper grade and alignment under all working conditions. Maintain base of forms directly in contact with the finished subgrade and base.
- G. Building of pedestals of earth or other materials upon which to rest forms in order to bring them to the required grades will not be permitted.
- H. Clean and coat forms with form release compound before concrete is placed against them, each time they are used.
- I. Do not remove forms from freshly placed concrete until the concrete has set for 12 hours.

3.03 PLACING CONCRETE REINFORCEMENT

- A. When reinforcement is indicated, provide deformed bars, welded wire fabric, or prefabricated welded or clipped deformed bar mats, as indicated on the Contract Drawings, and of size and quantity indicated.
- B. Place reinforcement so that the extreme longitudinal member will be located not more than 3 inches from the sides of the slab section, and extend the end of all longitudinal members to within 2 inches of the ends of slab sections.

- C. Lap adjacent sheets of welded wire fabric and welded or clipped mats not less than 12 inches when the lap is made at right angles to the centerline of the pavement and where wire fabric sheets are permitted to be lapped parallel to the centerline.
- D. Wrap the wire fabric or bar mats together with wire at all laps, at intervals not exceeding 24 inches.
- E. Reinforce multiple lane construction with bar mats or sheets of welded wire fabric of same weight and size as though the paving were constructed in single lane widths. Install mats or sheets so as to leave an unreinforced longitudinal gap 6 inches wide, parallel to and centered on the lane lines.
- F. Place tied bars or prefabricated bar-mat reinforcement securely supported on approved chairs as specified in Section 03 20 00, Concrete Reinforcing, and ACI 318. Install reinforcement in place on supports on the subgrade for a distance ahead of the paver equal to at least 500 feet or a two-hour run of the paver, whichever is greatest, before any paving is begun. Stop paving and install a bulkheaded construction joint whenever the paver comes to within 100 feet of the end of such steel placement. Secure reinforcement against displacement during concrete placement.
- G. Tie Bars and Dowels:
 - 1. Uniformly place all tie bars and dowel assemblies at the indicated depth below finished surface on 4-foot centers or other dimensions where indicated otherwise on the Contract Drawings.
 - 2. In all of the above methods of reinforcement placement, install dowel bar assemblies and secure in place in metal chairs on the subgrade, ahead of the placement of the slab reinforcement and concrete.
 - 3. Support tie bars for weakened-plane joints on metal chairs and securely fasten prior to placing concrete, or place on top of the freshly poured concrete and vibrate to position at proper depth. Install tie bars in such manner that upon initial set of the concrete they will be at proper alignment, depth and spacing, and at right angles to the designated line of cut.
 - 4. Place tie bars for construction joints on metal chairs, or machine place, in such a manner that upon the initial set of the concrete, they will be at proper alignment, depth, and spacing, and at right angles to the formed edge of the joint.

3.04 PLACING CONCRETE

- A. Notify the Engineer at least 24 hours in advance of placing concrete.
- B. In the event completion of concrete placement during darkness should become necessary, provide a lighting system adequate to illuminate all concrete-placement operations.
- C. An interval of more than 45 minutes between placing of two consecutive concrete batches will be cause for stopping paving operations. Should this occur, place a bulkhead with construction joint keyway.
- D. Place concrete while fresh. Retempering of concrete will not be not permitted.
- E. Do not chute concrete directly on to subgrade or base from any type of hauling unit without written permission from the Engineer.

- F. Place concrete pavement in full traffic lane widths, separated by construction joints; or if approved, the concrete pavement may be placed monolithically, two or more traffic lanes wide without a construction joint, but with a longitudinal weakened-plane joint at each traffic lane line.
- G. Deposit concrete in successive batches on the subgrade or base to full width of traffic lane and strike off with an approved screed-type finishing machine.
- H. When constructing adjacent traffic lanes, the wheels of the finishing machine that rest on previously completed concrete shall be flat, without flanges, and the inside edge of the tread of the wheels shall not operate so close to edge of slab as to cause spalling or damage. The tread of the wheels shall not be less than 3-inches in width. The wheels on the opposite side that operate on the steel side forms shall have flanges on both sides.
- I. Use a mechanical spreader of an approved type, designed to move the volume of freshly deposited concrete transversely.
- J. Use concrete already placed in adjacent traffic lane, curb, or gutter as the form for new concrete placed adjacent thereto, but not until the concrete placed in the first lane has attained a split tensile strength of at least 300 pounds per square inch, as determined by ASTM C496.
- K. Consolidate concrete by means of suitable vibrating screed, internal vibrator, or other approved vibratory equipment such that the concrete is effectively consolidated without segregation. Maintain amplitude of vibration such that the vibrations are perceptible on the surface of the concrete at least one foot from the vibrating equipment. Provide a device for measuring and indicating the actual frequency of vibrations.
- L. Perform screeding and tamping by making one complete pass over the entire area of the pavement. Adjust the tamper to produce the proper tamping action and adjust screeds to an elevation slightly above finished grade, so that when properly consolidated and finished, the completed surface of the pavement will be at the required grade, true to cross section indicated, and free from laitance and porous areas.
- M. Concrete required to be placed in widths less than a normal traffic lane may be compacted and shaped by a powered mechanical compacting and shaping machine supplemented by hand methods as necessary. Deposit concrete as nearly as possible in its final position. Do not use vibrators for extensive shifting of masses of fresh concrete.

3.05 JOINTS

- A. General:
 - 1. Joints in pavement are designated as longitudinal and transverse construction joints, transverse expansion joints, and longitudinal and transverse weakened-plane joints.
 - 2. Construct the faces of all joints normal to the finished surface of the road.
 - 3. Construct transverse joints normal to the centerline of the road and extending full width of pavement. Construct similar types of transverse joints in line with each other across the full width of the pavement.
 - 4. Construct longitudinal joints coincident with or parallel to the pavement centerline.
 - 5. Install load transfer devices parallel to finished surface of the road.
 - 6. Maintain finished surface of concrete in the same plane on both sides of a joint.
- B. Construction Joints:

1. Construction joints shall be made when placing fresh concrete against hardened concrete at planned locations and elsewhere when concreting is interrupted for longer than 45 minutes.
2. Connect concrete on both sides of longitudinal construction joints with tie bars as indicated.
3. Do not place transverse construction joints within 10 feet of any other transverse joint. Should it become necessary to stop concreting for a period of time sufficient to require the installation of a bulkhead and construction joint within 10 feet of an existing transverse joint, remove and waste the concrete that has been placed beyond the existing joint.

C. Transverse Expansion Joints:

1. Form transverse expansion joints at indicated locations by means of preformed expansion joint filler. Support the joint strips in position by means of metal holders and end supports. Hold the supports firmly in position during concreting, and maintain them in place after completion of pavement.
2. Use metal holders fabricated of minimum 16-gage sheet steel in the form of a deep channel extending not less than 4 inches downward on both sides of the joint strip, slotted and cut away as necessary to allow the concrete to make close contact with the joint strip at close intervals. Spread ends of holders to admit the end supports.
3. During placement and consolidation of concrete, secure joint holder and end supports so as to prevent movement of the joint strip and to keep the top edge of the joint strip approximately 1/2 inch below the surface of finished pavement. After concrete has been placed and consolidated, the metal holder may be removed and a suitable metal channel substituted therefore; fit the channel snugly over the top edge of the joint strip and maintain it there until the joint is edged.
4. After side forms are removed, remove concrete that has flowed around the ends of the joint filler.

D. Weakened-Plane Joints:

1. Construct weakened-plane joints with a power concrete or masonry saw to a depth of not less than 2 inches and a width of 1/4 inch, plus or minus 1/16 inch. Produce clean cuts with sharp edges and no dislocation of coarse aggregate.
2. Saw weakened-plane joints not less than twelve hours nor more than twenty-four hours after placing concrete, unless otherwise approved by the Engineer. Conduct night operations if necessary to meet these time limits. Maintain a stand-by power concrete saw on the site at all times when paving operations are under way.
3. Do not saw where volunteer transverse cracks exist. If a volunteer transverse crack exists within 5 feet of a planned, sawed joint, omit the sawed joint, but do not omit more than three consecutive planned, sawed joints.
4. Restore curing compound disturbed by sawing operations. Conduct sawing operations in such a manner that the surface and edges of pavement will be unprotected for not more than 20 minutes.
5. At the Contractor's option, longitudinal weakened-plane joints at traffic lane lines in multilane monolithic concrete pavement may be formed by placing a continuous strip of

plastic or other approved material that will not react adversely with the concrete. Use joint insert material of such width and character that, when placed vertically in the concrete, it will not bond with the concrete and will form an effective weakened-plane joint not less than 2 inches deep.

6. Insert the joint material with a mechanical device that places the material in a continuous strip, except where intervening structures break the continuity of paving. Splices in joint material will be permitted if splices are effective in maintaining the continuity of the joint material as placed.
7. Maintain top of joint material not more than 1/8 inch below finished surface of concrete. Do not deform joint material from a vertical position. Maintain alignment of finished joint parallel with center line of pavement, and free of local irregularities that exceed 1/2 inch, measured by a 12 foot straightedge, except for normal curvature of center line alignment.
8. Use a mechanical installation device to vibrate the concrete during placement of the strip, to cause the concrete to flow evenly about the joint material.
9. On completion of joint sawing, or on removal of the optional joint insert material, clean the joint and remove moisture by blowing with compressed air if necessary. Fill the joint with joint sealing compound in accordance with the manufacturer's instructions.

3.06 FINISHING

- A. Following placing of concrete and after it has been screeded with a transverse finishing machine, screed longitudinally with a power-operated longitudinal finishing machine of an approved type. Work longitudinal screed cross-wise so as to level any irregularities in the surface.
- B. Following longitudinal screed, use an approved scraping strike off for removing any accumulation of excess mortar, laitance, or inert material from the surface.
- C. For the final finish, drag surface with a single full width strip of burlap to produce a uniform gritty texture on the surface. Keep burlap wet and periodically wash out to remove accumulations of mortar.
- D. After burlap dragging has been completed and concrete has taken its initial set, use an edging tool with 1/4 inch radius along each edge of the surface to prevent chipping of the edges in the removal of forms. Tool in same manner the longitudinal edge of any concrete surface adjoining previously placed pavement, to avoid subsequent spalling. Edge all joints at the same time, working from suitable bridges. Take particular care to keep surface of concrete in the same plane on both sides of each joint. Kneeling planks will not be permitted on the concrete surface.
- E. Where special circumstances require, hand float finishing may be substituted for a finishing machine, providing the following requirements are met:
 1. Use float of approved design and construction to provide a true floated surface.
 2. Operate each float from the side of the pavement and parallel to the centerline of the pavement.
 3. Use edge of float to cut down high areas. Float removed material into depressions until a true surface is obtained.
 4. On each successive passage of the float, slightly lap the previous path; and, upon completion of each passage, bring the float back and smooth the overlap between the two passages.

5. Operate floats as far back of tamping machine as the concrete remains workable, with sufficient passes to remove perceptible irregularities.
6. Maintain at least one spare float in good condition and available on the worksite at all times.

3.07 CURING AND PROTECTION

- A. Comply with the applicable requirements of Section 03 35 00, Concrete Finishing, for curing concrete with liquid membrane-forming curing compound. Do not permit traffic on new concrete pavement until the concrete has attained its 28-day compressive strength as determined by strength tests in accordance with ASTM C39.

3.08 INSTALLATION OF JOINT SEALS

- A. Install joint fillers and sealing compounds where indicated in accordance with applicable requirements of Section 03 15 00, Concrete Accessories.

3.09 FIELD QUALITY CONTROL

- A. Strength Tests: The Contractor shall perform strength tests of concrete as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete.
- B. Thickness: After pavement is placed and cured, the Contractor shall take core samples at locations designated by the Engineer, for determination of actual thickness. A minimum of one core sample shall be obtained from each 100 feet of roadway for each lane.

END OF SECTION

SECTION 321621

CONCRETE CURBS, GUTTERS, AND WALKS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Materials and accessories.
- B. Preparation of sub grade.
- C. Types of construction.
- D. Joints.
- E. Form removal.
- F. Finishing.
- G. Curing and protection.
- H. Field quality control.

1.02 RELATED SECTIONS

- A. Preparation of sub grade to proper grade for concrete, including compaction, is specified in Section 31 00 00, Earthwork.
- B. Work shall conform with Section 73, Concrete Curbs and Sidewalks and Section 90, Portland Cement Concrete, of the Caltrans Standard Specifications with the following additions: Portland cement concrete, concrete reinforcement, and various materials, services, and incidentals pertaining thereto shall conform to Section 03 15 00, Concrete Accessories, Section 03 20 00, Concrete Reinforcing, Section 03 30 00, Cast-In-Place Concrete, and Section 03 35 00, Concrete Finishing.

1.03 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 117 Standard Specification for Tolerances for Concrete Construction Materials
 - 2. ACI 301 Standard Specifications for Structural Concrete
 - 3. ACI 318 Building Code Requirements for Reinforced Concrete
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 2. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

3. ASTM A663 Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties
4. ASTM C260 Specification for Air-Entraining Admixtures for Concrete
5. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
6. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete

C. City of Fairfield Standard Specification and Details

1.04 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work for submittal requirements and procedures.
- B. Product Data: Submit the respective manufacturer's product data for manufactured products.
- C. Shop Drawings:
 1. Submit drawings that indicate the section profile of curb and gutter, and the locations of joints in concrete, including construction joints, expansion joints, isolation joints, and contraction joints.
 2. Submit drawings of extruded curbs and gutters, if proposed, and any modification of the indicated section profile required by the extrusion process.
 3. Submit drawings of reinforcing steel, tie bars, and connecting dowels. Comply with requirements specified in Section 03 20 00, Concrete Reinforcing.

1.05 QUALITY ASSURANCE

- A. Tolerances:
 1. Construct concrete surfaces within 1/4 inch of the indicated elevation, and deviating not more than 1/8 inch from a 10-foot straightedge placed anywhere on the surface.
 2. Slab tolerances shall be "straightedge tolerance" as specified in ACI 117.
- B. Finishes: Slab finishes shall be as specified herein in accordance with the requirements of ACI 301.
- C. Site Mock-Ups: Provide site mock-up, in accordance with California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work, at least 3 feet by 4 feet in size, of slab finishes for walks, for the Engineer's review and approval. Site mock-ups require approval of the Engineer in writing before this work may proceed.

PART 2 - PRODUCTS

2.01 MATERIALS AND ACCESSORIES

- A. Concrete Reinforcement: Refer to Section 03 20 00, Concrete Reinforcing, for requirements.
- B. Portland Cement Concrete: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete, for requirements. All curb, gutter and sidewalk shall be constructed of 3000 psi portland cement concrete.

- C. Benches and Chairs: ACI 318.
- D. Tie Bars: ASTM A615, Grade 60, of type and size indicated.
- E. Dowels: Plain round bars meeting requirements of ASTM A615, Grade 60, or ASTM A663, Grade 80, epoxy-coated bars, furnished with approved snug-fitting ASTM A53 galvanized pipe sleeve. Provide sleeve with one end closed.
- F. Weep Holes: ASTM A53 galvanized pipe of size indicated.
- G. Expansion-Joint Filler and Joint Sealing Compound: Refer to Section 03 15 00, Concrete Accessories, for requirements.
- H. Surfacing Material for Nonslip Finish: Refer to Section 03 35 00, Concrete Finishing, for requirements.
- I. Concrete Curing Compound: ASTM C309, Type 1.
- J. Epoxy Adhesive: ASTM C881, Type V for load-bearing concrete, Grade and Class as determined by project conditions and requirements.
- K. Cushion: Shall be mechanically compacted Class 2 Aggregate Base.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

- A. Excavate for and prepare the sub grade as specified in Section 31 00 00, Earthwork, true to the indicated grade and cross section.
- B. Test completed sub grade for correct grade and cross section by means of template supported on side forms.
- C. Dampen sub grade and forms just before placing concrete.
- D. The finished subgrade immediately prior to placement of aggregate base shall be compacted to 92% for a depth of 0.5 feet.

3.02 TYPES OF CONSTRUCTION

- A. All curb, gutter, valley gutter and sidewalk shall be placed monolithically unless otherwise specified.
- B. Provide cast-in-place concrete construction, plain or reinforced as indicated. Curbs, gutters and valley gutters, shall be formed accurately to the indicated section profile with template screed.
- C. Use of an extrusion machine is allowed. A test pour may be required by the City Engineer. All edges shall have smooth even lines in both the horizontal and vertical plane. The grade tolerance is the same as formed concrete..

3.03 JOINTS

- A. Expansion Joints:
 - 1. Construct 3/8-inch to 1/2-inch thick expansion joints in the following locations unless otherwise noted:

- a. In curb and combination curb and gutter at the locations of expansion joints in the concrete roadway.
 - b. In curb or combination curb and gutter, at points where curved and tangent sections join.
 - c. Between curb or combination curb and gutter, and any drain inlet, or similar structure occurring within the limits of the curb or combination curb and gutter.
 - d. At corners in sidewalks, following the projections of the building lines from the corner of the building to the curb.
 - e. Between sidewalks and any permanent structure.
 - f. Between sidewalk and curb.
 - g. Through sidewalks at intervals not greater than 15 feet.
 - h. In sidewalks, encircling fixtures more than 12 inches in diameter.
2. Construct expansion joints as specified in Section 32 13 13, Concrete Paving, except that load transfer devices will not be required unless indicated. Shape preformed filler to cross section of curbs and combination curb and gutter.
- B. Contraction Joints: In sidewalks, provide contraction joints as indicated in uniform intervals not greater than 6 feet, with the edges rounded to a 1/4-inch to 3/8-inch radius.
- C. Tooling: Finish joints with an edging tool having 1/4-inch to 3/8-inch radius, leaving joints free of mortar and concrete. In preformed type joints, leave joint filler material exposed for full length of joint with clean and true edges.
- D. Joint Sealing:
1. Seal to within 1/8 inch of pavement surface joints in curbs and gutters, including gutter surfaces of combination curb and gutter sections; all joints between curbs and vehicular pavement; all joints between gutters and vehicular pavement; and all other expansion joints. Do not seal other joints unless so indicated.
 2. Do not seal joints until concrete curing is complete. Prior to installation of the joint sealing compound, clean the joints of dirt and other foreign material. Joints may be cleaned with compressed air jets provided that the air in such jets is free of oil or water. Do not fill joints when there is any free water in or adjacent to the joints. Joint walls and all surfaces to which the sealing material is to adhere shall be surface dry for at least three hours prior to sealing.
 3. Apply with approved pressurized equipment. Perform sealing of joints to make them impervious to water and to prevent the sealing compound from spreading over the surface of the pavement.

3.04 FORMS

- A. Lumber used for forms must be surfaced on the side placed next to the concrete and shall not be less than 1-1/2 inches thick after being surfaced. Warped forms and forms not having a smooth, straight upper edge shall not be used. Benders or thin planks, rigidly placed, may be used on curves, grade changes, or the curb returns.

- B. All forms shall be clean and coated with a light anti-bonding oil to prevent the concrete from adhering to them. All forms must be carefully set to proper alignment and grade and shall be rigidly held in place by the use of steel or wooden stakes. Clamps, spreaders and braces shall be used where required to insure rigidity in the forms.
- C. Forms shall not vary from vertical grade by more than 0.02 feet and from horizontal alignment by more than 0.05 feet within the distance not to exceed 25 feet at each occurrence. Unnecessary meandering of the alignment shall be sufficient cause for rejection and removal. All forms shall have smooth even lines in both the horizontal and vertical plane. A windrow of earth placed against the forms prior to placing concrete may be required to prevent them from bulging.
- D. Form Removal.
 - 1. Remove front curb forms not less than two nor more than six hours after placing concrete, but in no case while the concrete is still plastic enough to slump.
 - 2. Remove other forms not less than twelve hours after finishing is completed.

3.05 PLACING and FINISHING

- A. No concrete shall be placed or finished in the rain. It shall be the contractor's responsibility to schedule his operations such that concrete will not be placed or finished in the rain.
- B. Finished concrete shall have a high quality appearance. Defects such as crooked joints, exposed aggregate, surface pitting, or excessively rough finish will be cause for rejection. Removal and replacement will be done at Contractor's expense.
- C. Placement of driveways and handicap ramps require careful journeyman quality finishing. Through the driveway flowline a tangent line should be projected from full curb to full curb to assure that the 1" driveway lip does not 'encroach' into the flowline. The longitudinal curbline extension score line through the driveway shall be 6" from flowline. To assure positive flow, driveways and handicap ramps will be flow tested during installation.
- D. At the end of each day's pour, when work is terminated, or when a delay of more than 30 minutes occurs, a construction joint, consistent with the jointing pattern, shall be made vertical or square ended and shall end the work. In no case shall the end of a day's pour terminate in a driveway or handicap ramp.
- E. Curb, Combination Curb and Gutter and Valley Gutter:
 - 1. Trowel the face of curb smooth to a depth of not less than 2 inches below the flow line, or to the flow line of integral curb and gutter, and finish with a steel trowel, all immediately after removal of front curb forms.
 - 2. Finish all curb edges with a radius of 1/2-inch or as noted on plans.
 - 3. Provide a final fine brush finish to both top and face of curb with brush strokes parallel to the line of the curb, so that both top and front face present the same uniform appearance.
 - 4. Keep the curb face wet during above finishing operations.
 - 5. Allow no coarse aggregate to show on the finished curb surface.
- F. Sidewalk, Median Paving, and Ramps:

1. After the concrete has been placed, consolidated, struck off, leveled, grooved and edged as specified herein and in Section 03 30 00, Cast-In-Place Concrete, and in Section 03 35 00, Concrete Finishing, do not work the concrete further until ready for floating.
 2. Provide "floated finish" or light "broom finish" as indicated in accordance with the requirements of ACI 301.
 3. For pedestrian and wheelchair ramps, and all other surfaces where the Contract Drawings require a non-slip finish, provide a "nonslip finish" in combination with a "floated finish" or "broom finish" in accordance with the requirements of ACI 301.
 4. Broom finish shall be applied perpendicular to the direction of traffic flow.
- G. Joints and Edges: As soon as the condition of the work permits, perform joint work, edging, and marking. Weakened plane joints and score lines shall be constructed according to the standard details, and at right angles to the curb line.

3.06 CURING AND PROTECTION

- A. Comply with the applicable requirements of Section 03 35 00, Concrete Finishing, for curing concrete with liquid membrane-forming curing compound. Do not permit traffic on new concrete pavement until the concrete has cured a minimum period of ten days.
- B. Provide damp curing only, in accordance with Section 03 35 00, Concrete Finishing, for concrete slab surfaces indicated to be treated with concrete hardener and dust proofer.

3.07 FIELD QUALITY CONTROL

- A. The Contractor shall perform inspections and tests as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete. The Contractor shall provide such samples and services to facilitate testing as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete.
- B. After construction, gutters shall be checked by flowing water. The Engineer or his representative must be present during the flow test. Any high spots or depressions revealed by the flow test (which exceed 0.02 foot) shall be repaired by removing that section of concrete and replacing it to the correct grade.
- C. Finished face of curb shall not vary by more than an aggregate total of 0.05 foot from the design alignment within a distance not to exceed 25 feet at each occurrence. Unnecessary meandering of the alignment shall be sufficient cause for rejection and removal.

END OF SECTION 32 16 21

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SECTION 321713
PARKING BUMPERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Parking bumpers.
- B. Adhesive.
- C. Steel bars for installation.

1.02 REFERENCES

- A. State of California, Department of Transportation (Caltrans), Standard Specifications, 1992 edition:
 - 1. Section 95 Epoxy

1.03 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work, for submittal requirements and procedures.
- B. Shop Drawings: Submit Shop Drawings of bumpers, including plan layout and installation details, for approval.
- C. Product Data: Submit manufacturers' product data of precast bumpers and epoxy adhesive for approval.

1.04 QUALITY ASSURANCE

- A. Precast parking bumpers shall be manufactured for the intended purpose by a company or firm specializing in the manufacture of precast concrete parking appurtenances.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Parking Bumpers:
 - 1. Provide precast concrete parking bumpers of half octagonal configuration and dimensions indicated. Unless indicated otherwise, provide bumpers of 36-inch length.
 - 2. Bumpers shall be manufactured of Class 4000 reinforced concrete, as specified in California Department of Transportation (Caltrans), Standard Specifications (2010), Section 90, Concrete, to withstand constant use and rough service. Each bumper shall be reinforced with two No. 4 deformed steel reinforcing bars, minimum.
 - 3. Each bumper to be installed on at-grade asphalt pavement shall be manufactured with two holes to accommodate the installation rebar. Holes shall be positioned 6 inches in

from each end.

4. Bumpers to be installed on concrete slabs of parking structures, shall be manufactured without holes.
- B. Adhesive: Adhesive for anchoring bumpers or wheel stops to pavement shall be an epoxy adhesive manufactured for the purpose, similar and equal to the adhesives specified in Section 95 of the Caltrans Standard Specifications, Article 95-2.04 or 95-2.05.
- C. Steel Bars for Installation: Epoxy-coated rebar, No. 5 size, conforming with applicable requirements of Section 03 20 00 - Concrete Reinforcing.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Precast concrete bumpers shall be anchored and secured in position on at-grade asphalt pavements, as indicated, with two No. 5 epoxy-coated rebar and an appropriate epoxy adhesive as specified in Article 2.01.B herein.
- B. Precast concrete bumpers shall be secured in position on at-grade concrete pavements, as indicated, with an appropriate epoxy adhesive as specified in Article 2.01.B herein.

END OF SECTION 32 17 13

SECTION 321723
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Traffic line paint.
- B. Application of traffic striping and control markings.

1.02 RELATED SECTIONS

- A. Asphalt pavement is specified in Section 32 12 16 - Asphalt Paving.
- B. Concrete pavement is specified in Section 32 13 13 - Concrete Paving.
- C. Concrete curbs, gutters, and walks are specified in Section 32 16 21 - Concrete Curbs, Gutters, and Walks.
- D. All other painting is specified under Division 9, Finishes.

1.03 REFERENCES

- A. State of California, Department of Transportation (Caltrans), Standard Specifications, 1992 edition:
 - 1. Section 84 Traffic Stripes and Pavement Markings
- B. California Air Resources Board (CARB):
Latest regulations governing permissible content of Volatile Organic Compounds (VOC) in paints

1.04 SUBMITTALS

- A. General: Refer to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 5, Control of Work, for submittal requirements and procedures.
- B. Shop Drawings: Submit drawings and diagrams, indicating stripe width of roadway divider stripes and parking stalls, configuration and dimensions of directional arrows, style and size of letters for "compact car" designation, configuration and dimensions of international handicapped symbol, and any other traffic control markings on pavement, such as "in" and "out" or "enter" and "exit" designations as indicated.
- C. Certificate of Compliance: Submit evidence or affidavit that certifies that paint to be used complies with latest CARB/VOC regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Traffic Line Paint: Provide paint conforming with the requirements of Section 84-3 of the Caltrans Standard Specifications, white in color for traffic striping, parking stalls, and other

control markings on pavement, yellow in color for traffic control markings where indicated, blue in color for accessible parking stalls, red in color for curbs where no parking is indicated, white in color for curbs where passenger discharge and pickup are indicated, and white-yellow-green striping on curbs where taxicab parking is indicated.

1. Provide glass beads only for traffic stripes and control markings on road or street pavements.
- B. Plaza Pavement Markings: Provide durable, white, anti-slip paint from Richco International Products, Inc., or Rust-oleum Industrial Flooring "Tough and Easy", or approved equal.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Provide traffic striping and control markings on pavement and parking stalls in accordance with the layout, configurations, and dimensions indicated on the Contract Drawings and approved Shop Drawings.
- B. Paint application equipment shall conform with the applicable requirements of the Caltrans Standard Specifications.
- C. Traffic control markings and parking stalls shall be applied with the use of substantial cutout patterns and templates, or with striping equipment that applies straight, uniform width, sharp lines. Coverage of paint shall be thorough and complete in accordance with the paint manufacturer's instructions and recommendations.
- D. Where "enter" and "exit" control markings are side-by-side on pavements, indicating two-way traffic, such "enter" and "exit" designations shall be different colors, such as white and yellow, with a centerline separating the two directions of traffic.
- E. Traffic control markings and parking stalls shall be sharp and accurate, straight where required, without fuzziness at edges of lines.
- F. Accessible parking stalls shall include the International Symbol for Accessibility.
- G. At completion, the Contractor shall check the work thoroughly and shall touchup traffic control markings and parking stalls that are not distinct or thorough in coverage, or are not uniform in color.

END OF SECTION 32 17 23

SECTION 321726

DETECTABLE WARNING TACTILES

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section includes specifications for detectable warning tactile and curb ramp detectable warning surface.

1.02 REFERENCE STANDARDS

- A. ASTM International (ASTM):

1. B117 Practice for Operating Salt Spray (Fog) Apparatus
2. C501 Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
3. C1028 Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
4. 0570 Test Method for Water Absorption of Plastics
5. 0638 Test Method for Tensile Properties of Plastics
6. 0695 Test Method for Compressive Properties of Rigid Plastics
7. 0790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
8. 01308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
9. 05420 Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
10. E84 Test Method for Surface Burning Characteristics of Building Materials
11. G26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000, replaced by G155)

- B. Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA)

- C. Caltrans Standard Plan A88A and A88B

1.03 SUBMITTALS

- A. Shop Drawings: Submit shop drawings showing fabrication details; panel surface profile; fastener locations; plans of panel placement including joints, and material to be used as well as outlining installation materials and procedure. Include procedures for containment and disposal of milling and sawcutting waste water.
 - 1. The shop drawings do not require a full dimensional layout of the platform edges.
- B. Product Data: Submit manufacturer's literature describing products and installation procedures. Include product data for adhesives and sealants.
- C. Samples: Submit the following samples:
 - 1. Samples of panels measuring at least 12 inches x 12 inches. Panel sample shall include longitudinal edge with integral flange and transverse ship-lap edges.
 - 2. Samples of panels and sealant for verification of color match.
- D. Samples for Verification Purposes: Submit panels of the kind proposed for use.
- E. Maintenance Instructions: Submit manufacturer's specified maintenance practices for each type of panel and accessory as required.
- F. Quality Assurance Submittals:
 - 1. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. Tests which indicate performance for the panels shall have been performed within 3 years of the Invitation to Bid.
 - 2. Submit list of projects in California that successfully demonstrate the proposed products' durability and weatherability.

1.04 QUALITY ASSURANCE

- A. Provide panels and accessories, including panel adhesive, fasteners, and sealants, shall be from a single source. Products shall have been in successful service for a period of five (5) years.
- B. Installer's Qualifications: Engage an experienced Installer certified in writing by panel manufacturer as qualified for installation, who has successfully completed panel installations similar in material, design, and extent to that indicated for Project. Only persons who are thoroughly trained and experience in the installation of the panels shall perform the work.
- C. Provide services of manufacturer's field representative who shall be present at all times during installation.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Panel type shall be identified by part number on packages.

1.06 SITE CONDITIONS

- A. Environmental Conditions and Protection: Conduct field operations only when environmental conditions fall within those recommended by manufacturers of the products.

1.07 WARRANTY

- A. Detectable warning tactile and curb ramp detectable warning surface shall be covered by a written warranty for a period of five years from date of final acceptance. The warranty includes defective work, breakage, and deformation, delamination, fading and chalking of finishes, and loosening of tactiles. Warranty shall include furnishing new materials, removal of existing tactiles, and installation of new tactiles.

1.08 EXTRA STOCK

- A. Furnish not less than five (5) percent additional panels of the total amount installed of each panel and corresponding fasteners. Deliver extra stock to location (within 30 mile radius of work site) designated by the Engineer. Furnish extra stock materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification.

PART 2 - PRODUCTS

2.01 PANELS

- A. Manufacturers: Subject to conformance with the requirements of this Section, use products fabricated by the following manufacturers or equal:
 - 1. Transit-Tile of Boulder, CO
 - 2. Armor-Tile by Engineered Plastics, Inc. of Williamsville, NY
 - 3. ADA Solutions, Inc. of North Billerica, MA
- B. Detectable warning tactile and curb ramp detectable warning surface shall be homogenous glass and carbon reinforced composite or an epoxy polymer composition which is colorfast and UV stable. Color shall be homogenous throughout tactile. Color shall be Federal Yellow.
- C. Truncated Dome Geometry:
 - 1. Truncated dome surface shall comply with ADA and ABA guidelines, 705, Detectable Warnings. (Title 49 CFR Transportation, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 - Detectable Warnings on Walking Surfaces).
 - 2. Truncated Dome Description:
 - a. Staggered Dome and In-Line Patterns: The truncated dome shall measure a nominal 0.45 inch diameter at the top of the truncated dome, 0.90 inch diameter at the base of the truncated dome, 0.20 inch high, and 2.35 inch on center, staggered or in-line pattern.
 - b. In order to ensure a uniform appearance of the detectable warning surface throughout the transit system, equivalent facilitation findings or alternate patterns will not be acceptable.
 - 3. Truncated dome pattern shall align properly from Tactile to Tactilel.
- D. Panel Configuration:
 - 1. Standard Detectable Warning Tactile - Butt Joint, Staggered Truncated Domes: Nominal 24 inches x 48 inches x 3/8 inches thick with a 7/16- inch thick deep flange along both 4 foot sides unless noted otherwise on the Contract Drawings. The perimeter of the standard panel features a chamfer (no 90 degree return).

2. The detectable warning tactile shall feature a butt joint detail from tactile to tactile. Alternatively a ship lap detail may also be furnished.

E. Fastener Holes in the Panel:

1. Holes for fasteners shall be formed in the factory. Holes for fasteners, whether made in the factory or in the field, shall be located only at the centers of the truncated domes.

- F. Detectable warning tactile and curb ramp detectable warning surface comply with the following performance characteristics. Alternatively, products complying with the performance characteristics specified in California Department of Transportation (Caltrans), Standard Specifications (2010), will be acceptable if the panel configuration described in this Section is furnished.

Property	ASTM Test Method	Nominal Value
Accelerated Weathering (3,000 hours)	G26	Delta E maxd. Of20
Chemical Resistance	01308	No Stain
Flexural Strength	0790	min. of 20,000psi
Compressive Strength	0695	min of 20,000psi
Tensile Strength	0638	min of 10,000psi
Gardner Impact Test	05420	min. of 110 in-lb
Flame Spread	E84	FSI of less than 25 SOI of less than 150
Slip Resistance	C1028	min of 0.80
Wear Resistance	C501	min of 500
Water Absorption (2 weeks)	0570	Less than 0.20%
Salt Spray (120 hours)	B117	No Change

2.02. ACCESSORIES

- A. Fasteners for Concrete: Color matched nylon expansion sleeves with 1/4 inch diameter by 1-1/2 inches long stainless steel drive pins or as recommended by panel manufacturer for specific job conditions and accepted by the Engineer.
- B. Adhesive: Type approved by the panel manufacturer.
- C. Sealant: Urethane sealant of type approved by the panel manufacturer.
- D. Backer Road: Acceptable to sealant manufacturer where required, such as at platform expansion joints.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Apply adhesives, sealants and mechanical fasteners in strict accordance with the guidelines set by their respective manufacturers.

- B. Utilize manufacturer-provided template to lay out area to receive tactiles.
- C. Form recess for tactiles by either milling with diamond blade head or casting recess in place (at new paving) so that installed tactile will still flush relative to adjacent surface. Grind or form to the depth and width required by the approved shop drawings and manufacturer's instructions. Finish cast-in-place recess with equivalent of a light broom finish. When milled, substrate shall have a light ribbed finish.
- D. Contain and remove slurry resulting from concrete milling and sawcutting. Do not wash slurry into track bed area.
- E. For Tactiles with Recessed Flanges:
 - 1. Utilize diamond bladed double headed wet saw to achieve parallel grooves to receive panels. Both sawcuts shall be made simultaneously from the same machine. Sawcut parallel to platform edge.
 - 2. After sawcutting, vacuum and power wash surface with clean clear water, free from all dirt and debris. Visually inspect surface for obtrusions or foreign matter. If obtrusions are present, remove by grinding. Remove foreign matter by grinding or further washing, as appropriate.
- F. Immediately prior to application of the setting adhesive, inspect surfaces to receive tactile to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oils, grease, sealers, and other contaminants. Verify that surfaces are structurally sound and that concrete has cured a minimum of 30 days. Obtain tactile manufacturer's representatives and Engineer's approval of surface preparation before installing panels.
- G. Set tactiles and install fasteners in accordance with tactile manufacturer's instructions and as follows:
 - 1. Wherever possible, install full size (uncut) tactiles. Do not install tactile sections measuring less than 24 inches in length. Only cut tactiles where absolutely necessary.
 - 2. Maintain gap between tactiles for expansion and contraction in accordance with manufacturer's instructions.
 - 3. At platform expansion joints, cut tactiles on their short sides, finish cut edges smoothly, and lay tactiles with cut edges aligned with the edges of the substrate along the joints. Install fasteners on either side of the expansion joint at the time of initial installation. After a minimum of 4 hours, make a sawcut measuring 5/16 inch wide across the composite detectable warning tactile and fill with sealant. Make sawcut in the zone between truncated domes.
 - a. Where there is platform curvature, composite detectable warning tactiles shall be treated in a similar manner so that the joints remain uniform across the width of the joint between successive tactiles. However, in areas of platform curvature, the joint shall take on somewhat of a triangular configuration.
 - 4. Cutting through tactile domes shall be kept to a minimum. Where less than half of the truncated dome remains, grind off balance of dome; where over half of the truncated dome remains, feather dome so as not to present a tripping hazard.
- H. Install sealant in accordance with manufacturer recommendations.
- I. Installation of curb ramp detectable warning surface must comply with the manufacturer's recommendations.

3.02 CLEANING AND PROTECTING

- A. After the area has been fully tactiled and sealant system applied, clean panel surface, following the manufacturer recommended maintenance and cleaning procedures.
- B. Protect sealant and tactiles against damage during construction period. Comply with tactile and sealant manufacturers' recommendations.
- C. Protect tactiles against damage from rolling loads following installation by covering with plywood or hardwood.
- D. Clean and protect curb ramp detectable warning surface against damage following the manufacturer's recommendations.

END OF SECTION

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SECTION 321813
SYNTHETIC LAWN

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Synthetic Lawn Surfacing

1.2 SUBMITTALS

- A. Prior to installation, contractor to provide the following information:
1. Standard printed specification of the synthetic surfacing system that is being installed.
 2. Letter from synthetic surfacing manufacturer approving the installer/applicator of the synthetic lawn.
 3. Shop Drawings: Indicate details necessary for complete fabrication and installation, including spacing and sizes of connections and members, finishes of members, and other necessary information.
 4. Samples: Submit samples of finishes and colors of materials for approval by Engineer.
- B. Upon completion of specified work, contractor to provide closeout submittals as listed below.
1. Manufacturer's Warranty of ten (10) year minimum.
 2. Provide a Care and Maintenance manual for the Owner's use for future maintenance of the synthetic lawn.

1.3 QUALITY ASSURANCE

- A. Materials shall be guaranteed to the extent that the surfacing has been manufactured, applied, and will perform in accordance with the manufacturer's specifications.
- B. Synthetic Lawn contractor shall, in the presence of the owner, inspect the installed product as required by the owner throughout the duration of the warranty period. Defects in workmanship or materials shall be repaired by the contractor at no cost to the owner.

PART 2 - PRODUCTS

2.1 SYNTHETIC LAWN

- A. Basis of Design: SynLawn SF351, attached, or approved equal.

2.2 MODULAR MOLDED PLASTIC TILE SUBSTRATE

- A. Basis of Design: VersaCourt Game Court Tiles, attached, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.
- B. Inspect drainage conditions and confirm plumbing is operational prior to installation of synthetic lawn.

3.2 INSTALLATION

- A. Install in accordance with approved shop drawings.
- B. Installation shall be performed only by manufacturer approved contractors.

3.3 PROTECTION

- A. Protect finishes from damage during remaining construction by use of temporary protective coverings as approved by manufacturer. Remove protective covering at project completion. Restore finishes damaged during installation and construction period.

END OF SECTION



866-796-5296

PRODUCT NAME

SF351

MATERIALS

Primary Yarn Polymer	Polyethylene w/Heat Block™ Technology
Yarn Cross Section	Horseshoe Monofilament
Standard Color	Field Green/Lime
UV Stabilized	Yes
Fabric Construction	Tufted
Secondary Yarn Polymer Thatch	Polypropylene
Secondary Yarn Color	Turf Tan
Primary Backing	SLC02
Coating Type	Enviroloc™ Plus
Polyethylene Yarn Denier / Ends	10,800/6
Texturized Thatch Denier / Ends	5040/12
Sustainability	100% Recyclable
Warranty Period	10 years

Finish Fabric	English System		Metric System		ASTM Test F-1551
	Value	Units	Value	Units	
<i>Nominal Specification</i>					<i>Method</i>
Pile Height (Nominal)	2	inches	5.08	cm	D-5823
Face Weight	78	oz/yd ²	2581	g/m ²	D-5848
Total Fabric Weight	106	oz/yd ²	3508	g/m ²	D-5848
Primary Backing Weight	8	oz/yd ²	265	g/m ²	D-5848
Secondary Coating Weight	20	oz/yd ²	662	g/m ²	D-5848
Tuft Bind	>8	lbs.	>3.63	kg	D-1335
Grab Tear Strength (Average)	>200	lbs.	>91	kg.	D-5034
Lead Safe	<50	ppm	<50	ppm	F-2765
Total Yarn Linear Density	15,840	Denier	17,424	dtex	D-1577
Elongation to Break	>60	%	>60	%	D-2256
Yarn Breaking Strength	>19	lbs.	>8.62	kg	D-2256
Yarn Melting Point	248	F°	120	C°	D-7138
Stitch Rate	3	in	7.62	cm	D-5793
Machine Gauge	3/8	inches	0.9525	cm	D-5793
Flammability	Test Passed		Test Passed		D-2859
Water Permeability	>30	in/hr	>76.2	cm/hr	DIN 18-035
Fiber Thickness (Primary / Secondary)	3.9	mils	100	microns	D-3218
Fabric Width	15	ft	4.6	m	None

Note: Any change from the specified values is considered a special product that will require confirmation from manufacturing. All values are ± 5%.

2/17/2012

IERBYS Temporary Improvements – Site

Synthetic Lawn

April 15th, 2013

321813-2
Final Construction Documents - Site

04-0120F4

05/03/13 PERMIT SET

SPECIFICATIONS

VersaCourt from VersaCourt International

Part 1 — General

1.01 Description

A. Scope of work

Furnishing of materials for the flooring system described below. The flooring is a modular interlocking suspended plastic tile system. Includes installation, application of game lines, and maintenance instructions for the flooring system.

B. Related Work Specified Elsewhere

1. Installation of concrete, asphalt, or other base material.
2. Preparation of base to provide a medium broom surface finish with tolerances of (\pm) or ($-$) $\frac{1}{4}$ " in any 10' radius.
3. Membrane waterproofing as determined by the project engineer.

insure protection against color fade and plastic deterioration & oxidations. The tile also have an anti-static additive which reduces static buildup on players on court.

4. Surface Texture — Specially designed open grid that provides a high grip surface in all weather conditions.

5. Tile Interlocking Mechanism — The tile interlocking system is designed to allow for thermal expansion and contraction without causing the surface to buckle. It also provides the player with lateral forgiveness.

6. Colors — Available colors are: Medium Green, Rust Red, Burgundy, Dark Green, Yellow, Royal Blue, White, Turquoise, Navy Blue, Graphite, Purple, Gray, Bright Red, Black, Hunter Green, Orange, Light Blue and Sand.

7. Support Structure — Each tile is supported by 155 cross posts. This provides a stable base while at the same time vertical flex.

8. Weight — 7 oz.

Part 11 — Warranties

2.01 Manufacturer's Limited Warranty

A. VersaCourt game tiles shall be warranted by the manufacturer for any defects in materials and workmanship for a period of 15 years from the date of purchase as set forth in the manufacturer's standard limited warranty.

2.02 Installers

A. Installer shall provide a one (1) year warranty on his workmanship as it pertains to the installation of the modular flooring and accessories.

B. VersaCourt Line Tiles

1. Description — An injection molded, high impact plastic line tile. Used to inlay straight lines in a court.
2. Size 10.13" x 2" x 3/4" thick
3. Material — Same as tile
4. Surface Texture — Same as tile
5. Tile Interlocking Mechanism — Same as tile
6. Colors — Same as tile
7. Support Structure — Same as tile
- 8, Weight — 1.5 oz.

Part 111 — Product

3.01 Materials

A. VersaCourt Game Court Tiles

1. Description — An injection molded, high impact plastic tile supplied in pre-assembled 4 units by 4 units sheets.
2. Size — 10.13" x 10.13", 3/4" thick
3. Material — Specially blended high impact polypropylene copolymer. UV stabilizer and anti-oxidant additives are molded into each tile to

C. VersaCourt Ramp Tiles

1. Description — An injection molded, high impact plastic ramp tile. Used around the edge of court as ramp from ground to tile level.
2. Size — 10.13" x 2" x 3/4" thick
3. Material — Same as tile
4. Surface texture — Smooth

5. Tile Interlocking Mechanism — Same as tile
6. Colors — Same as tile
7. Support Structure — Same as tile
8. Weight — 1.6 oz.

- G. R-Value: < 1.0
- H. Flatness: $\pm 1.5\text{mm}$
- I. Load Bearing Capacity: 180 psi

Part V - Execution

D. Line Stripe Painting

1. Primer- Used to promote adhesion between the tile surface and the paint.
2. Paint — Used to mark the playing lines required in various sports.
3. Logos — Custom logos may also be painted onto the surface of the tile.

Part IV - Physical Properties

4.01 Material Test Results

- A. Rockwell hardness (ASTM D 785): 83
- B. Heat Deflection @ .455 MPa (ASTM E 648): 194
- C. Flaming at 1000mm (ASTM E 648): 4 min 45s
- D. Auto-ignition temperature (ASTM D-1929): 980°F
- E. Vicat softening point (ASTM D-1525): 260°F
- F. Low Temperature Brittleness (ASTM D-2137): -25F
- G. Coefficient of Linear Thermal Expansion, (ASTM D-696, E-831): 63×10^{-6} (in/in)rF
- H. E-Modulus (ASTM 0-5418) 126,000 psi (850MPa)
- I. Flex Modulus (ASTM D-790) 122,000 psi
- J. Tensile Yield Strength (ASTM 0-638) 3,250 psi
- K. Elongation at Yield (ASTM D-638) 18%
- L. Notched izod (ASTMD-256) 15 ft-lb / in at 20°C

4.02 Product Test Results

- A. Flame Spread Index (ASTM E-162): 4 min. 30 sec.
- B. B. Smoke Development (ASTM E-162): 1 min. 46 sec.
- C. Radiant Panel (ASTM E-84,162,648): .12 Watts/cm²
- D. Friction Test (ASTM C-1028): Dry<.71, wet<.52
- E. Compression vs. Crush (ASTM 0-3998): No Break
- F. Noise Reduction Coefficient (ASTM C-423): 25%

5.01 Installation

A. VersaCourt Game Tile

1. Game tiles will be installed according to pre-approved layout.
2. Game tiles will be installed and/or supervised according to manufacturers specifications by an authorized, factory trained dealer or representative.

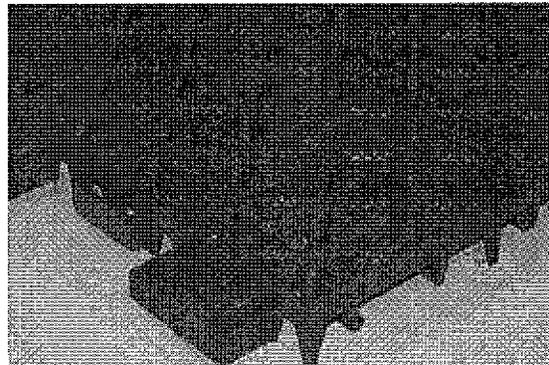
B. Game line painting

1. Floor surface shall be clean, dry and free of debris.
2. Lines shall be primed using Klean Strip's Bulldog adhesion promoter and then painted using Sherwin Williams-Acrolon polyurethane paint.

5.02 Maintenance

A. Maintenance Procedure

1. It is recommended to keep the surface free of leaves, limbs and grass clippings by using a leaf blower. Every 2-3 years it may be necessary to pull the tile up and sweep out any dirt or debris that may have accumulated under the tile.



VersaCourt Tile

SECTION 323113

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fencing, gate materials and synthetic panels.
- B. Concrete.
- C. Fence and gate installation.
- D. Electrical grounding.

1.02 FENCE CLASSIFICATIONS AND STANDARDS

- A. Fence Code: Type of fence, dimensions, components, gates, and accessories are indicated on the Contract Drawings.
- B. Fence Types: Chain link fencing shall be of the types indicated as follows:
 - 1. Type CL Polyvinyl chloride (PVC) coated steel fence fabric with vinyl-coated and factory-painted steel posts, rails, caps, hardware, and fittings in black color.
- C. Fence Standards:
 - 1. Caltrans Standard Plan A85, A85A and A85B

1.03 REFERENCES

- A. Chain link fence and gates shall be black vinyl-clad and shall conform to the provisions in Caltrans Standard Specifications, Section 80, Fences.

1.04 SUBMITTALS

- A. Submittals for chain link fence and gates shall be black vinyl-clad and shall conform to the provisions in Caltrans Standard Specifications, Section 80, Fences. G B. Product Data: Submit manufacturer's product data and specifications of the specified chain link fencing, gates and privacy-windscreen synthetic panels.
- C. Shop Drawings: Submit detailed Shop Drawings of the fences and gates layout, including installation details of the fencing, posts, gates, hardware, and accessories for review.
- D. Samples: If PVC-coated fencing is indicated or specified including screen panels, submit manufacturer's color chart of available colors and physical sample of selected color.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Requirements: Fencing shall include fabric covering, framework, privacy-wind screen panels concrete footings, gates, hardware, and all appurtenances and accessories as required for a complete installation. Heights of fences shall be as indicated.
- B. Components:
 - 1. Chain link fence fabric, components and gates shall be 11-gage, Type IV, Class B, bonded vinyl coated fabric, conforming to the requirements in AASHTO Designation: M 181. The color shall be black. Heights as noted on the construction plans.
 - 2. The strength of the bond between the coating material and steel of the bonded vinyl coated chain link fabric shall be equal to or greater than the cohesive strength of the polyvinyl chloride (PVC) coating material.
 - 3. Chain link fence Type CL-6 along the south boundary shall retain the existing posts. The posts shall be painted to match the fence fabric color coating.
- C. Synthetic Screen Panel
 - 1. Privacy wind screen panels on 10 foot high fence around transformer shall be synthetic material, polyethylene or similar, semi-open mesh, with color selected by owner to match IERBYS building. Product to be as listed, or approved equal.
 - a. Fencescreen Windscreen Products, 26834 Vista Terrace, Lake Forest, CA 92630, Standard 200 series. (880.313.6313)
 - b. Coversports.com, 5000 Paschall Avenue, Philadelphia, PA 19143, (800.445.6680), Fencemate Vinyl coated polyester, 600 series,
 - 2. Privacy wind screen panels on 8 foot high fence along east property line shall be synthetic material, polyethylene or similar, tight knit woven closed mesh, with metal grommets, black color. Product to be as listed, or approved equal.
 - a. Fencescreen Windscreen Products, 26834 Vista Terrace, Lake Forest, CA 92630, Standard 700 series. (880.313.6313)

2.02 CONCRETE

- A. Concrete for chain link fence and gate footings shall conform to the provisions in Caltrans Standard Specifications, Section 80, Fences.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Preparation for installation of chain link fence and gates shall conform to the provisions in Caltrans Standard Specifications, Section 80, Fences.

3.02 INSTALLATION

- A. Installation of chain link fence and gates shall conform to the provisions in Caltrans Standard Specifications, Section 80, Fences.

3.03 CONCRETE

- A. Handling and placing of concrete shall conform to the applicable requirements of Section 03 30 00 - Cast-In-Place Concrete.
- B. Place concrete around posts in a continuous pour. Check each post for plumb and vertical and top alignment, and hold in position during placement and finishing operations.
- C. Trowel finish tops of footings, and slope or dome to direct water away from posts. Set keepers, stops, sleeves, tracks, eye bolts, and other accessories into concrete as required. Wheel rolling area for sliding gates shall be steel-trowel smooth finish concrete.

3.04 ELECTRICAL GROUNDING

- A. Electrical groundings for chain link fence and gates shall conform to the provisions in Caltrans Standard Specifications, Section 80, Fences.

END OF SECTION 32 31 13

SECTION 330528

TRENCHING AND BACKFILLING FOR UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Bedding and Backfilling materials.
- B. Staking and grades.
- C. Existing Utilities.
- D. Trenching and excavating.
- E. Bedding and backfilling
- F. Trench borrow backfill with or without AC paving
- G. Field quality control

1.02 DESCRIPTION

- A. This section includes the requirements for excavating, trenching, backfilling and borrow backfilling with or without AC paving for installation of new utilities, pipe casings, and related structures, as indicated, including utility manholes and concrete encasement.
- B. Trenching and backfilling and borrow backfilling with or without AC paving for utilities include restoration of existing facilities, where applicable, to the existing condition prior to excavation.

1.03 RELATED SECTIONS

- A. Section 31 23 19, Dewatering
- B. Section 31 00 00, Earthwork
- C. Section 32 12 16, Asphalt paving
- D. Section 33 05 25, Support and Protection of Utilities
- E. Section 33 05 35, Protection, Removal and Abandonment of Utility Pipes

1.04 REFERENCE STANDARDS

- A. American Society for Testing Materials (ASTM):
ASTM C33 Specification for Concrete Aggregates
- B. City of Fairfield Standard Drawings and Specifications
- C. AREMA Trench and Backfill Requirements

- D. Union Pacific Railroad (UPRR) Trench and Backfill Requirements
- E. Borrow backfilling with or without AC paving

1.05 REGULATORY REQUIREMENTS

- A. Regulatory requirements, which govern the work of this Section, include the following governing codes:
 - 1. California Code of Regulations (CR), Title 8, Chapter 4, Subchapter 4 - Construction Safety Orders, and Subchapter 19 – Trench construction Safety Orders, for trench excavations of 5 feet or more in depth.
 - 2. California Code of Regulations, title 24, Part 2, California Building Code, Chapter 33, and Appendix Chapter 33, Excavation and Grading, for protection of the public.

1.06 SUBMITTALS

- A. General: Refer to SC-6, Contract Data Requirements, and GC-43, Submittal of Shop Drawings, Product Data and Samples, for submittal requirements and procedures. Submittals for trenches of 5 feet or more in depth shall be submitted to the Engineer for review and approval.
- B. Shop Drawings: Conform to the submittal requirements of Section 31 50 00, Excavation Support and Protection. All such submittals shall be prepared, sealed, and signed by a professional civil or structural engineer currently registered in the State of California.

PART 2 - PRODUCTS

2.01 BEDDING AND BACKFILLING MATERIALS

- A. Bedding: Unless specified otherwise by public utility owners in their respective Standard Documents, the bedding material shall be:
 - 1. Sand: Sand for bedding of pipe in utility trenches shall be a clean and graded, washed sand, all passing No. 4 U.S. Standard sieve, and conforming generally to ASTM C33 for fine aggregate. Finer sand may be used, if convenient, provided the sand is clean and does not contain deleterious substances in excess of the amounts specified in ASTM C33, Table 3.
 - a. Only sand will be permitted for bedding of concrete pipe, clay pipe, and cast-iron pipe.
 - 2. Pea Gravel: Clean and graded, washed river-run gravel, ASTM C33, Size No. 7. Pea gravel may be used in trenches requiring additional drainage and for backfilling above the pipe's upper half (above the horizontal centerline).
- B. Backfill Material: Backfill for excavations and trenched under structures shall be Structural Fill as indicated. Conform to Section 31 00 00, Earthwork. Common fill will be permitted only for backfilling of excavations and trenches in open areas and landscaped areas, conforming to the requirements of public utility owners for their respective utilities. Backfill under UPRR railway tracks for track restoration shall conform to the requirements of UPRR.
- C. Borrow backfill: Imported borrow backfill with or without AC paving shall conform to Section 19-7.02 of Caltrans Standard Specifications. The imported borrow shall be of a quality suitable for the purpose intended, free of organic matter or other unsatisfactory material. The contractor shall

notify the Engineer of the material sites so that the stripping materials may be taken and the material may be tested.

- D. Slurry Cement Backfill: Slurry cement backfill shall consist of a fluid, workable mixture.

PART 3 - EXCAVATION

3.01 STAKING AND GRADES

- A. Staking and grades for trench location shall conform to the requirements of GC-44 Survey Requirements, and Section 31 00 00, Earthwork.

3.02 EXISTING UTILITIES

- A. Contractor shall conform to the requirements of Section 33 05 25, Support and Protection of Utilities when excavating area adjacent to or below the existing utilities. Damaged utilities due to Contractor's negligence shall be repaired or replaced at Contractor's cost.

3.03 TRENCHING AND EXCAVATING

- A. Comply with CCR, Title 8, Trench Construction Safety Orders, and the California Building Code, Chapter 33 and Appendix Chapter 33, as applicable.
- B. The work of this Section shall conform to the requirements of Section 31 00 00, Earthwork, as applicable. Contractor shall also conform to the applicable jurisdictional agencies and UPRR requirements for trenching and backfilling. If conflicting requirements occur, the most stringent requirements apply.
- C. Perform trenching and excavating as indicated and required for utility piping, casings and related structures, and provide shoring, bracing, pumping, and planking as required and as specified in Section 31 50 00, Excavation Support and Protection.
- D. Excavate to the lines and grades indicated. Field verify location and depth of existing utilities prior to work requiring casing installation work. Over excavation will not be allowed or paid for, and shall be restored as directed by the Engineer at Contractor's cost.
- E. Excavate trenches for pipes and pipe casing by the open-cut method, except where jacking and boring operation is indicated. Hand-excavate for crossing or longitudinal pipelines or utility structures located within 3 feet to any existing structures.
- F. In paved areas, cut pavement along the neat lines at the width indicated for the trench. Pavement shall be sawcut at full depth. After compacting the backfill, restore pavement to a condition equivalent to that existing at the start of construction.
- G. Excavate trenches to the indicated width as all points below a horizontal plane 2 feet above the top of the pipe. Excavation above this plane may exceed the indicated width as required. Where the width is not indicated, make the width not less than 6 inches nor more than 18 inches from the outside wall of the new pipes, or pipe casings if the casings are to be installed.
- H. The bottom of excavations shall be firm, undisturbed earth or cut subgrade, clean and free from loose material, debris, and foreign matter. When bottoms of excavations or trenched are a soft or unstable material, the bed shall be made firm and solid by removing said unstable material to a

sufficient depth and replacing same with sand or pea gravel, compacted to at least 90 percent relative compaction.

- I. Where water is encountered in the trench, dewater as specified in California Department of Transportation (Caltrans), Standard Specifications (2010) , and provide sand or pea gravel as required to drain the water and stabilize the bed.
- J. Bell holes shall be accurately placed and shall not be larger that required to make the joint.

3.04 BEDDING AND BACKFILLING

- A. Provide firm and uniform support of piping at indicated elevations and grades. Carefully tamp bedding material as required for firm support.
- B. Backfill below the horizontal centerline of pipe shall be sand, unless specified otherwise in the Contract Plans. Backfill to 6 inches above the top of pipe from the centerline of pipe shall be the herein specified, as applicable, or as required by the public utility owners.
- C. Backfill shall be placed in 6-inch layers, leveled, rammed, and tamped in place. Each layer shall be compacted with suitable compaction equipment, taking care not to damage or misalign any pipe. Compact backfill to at least 90 percent relative compaction in open areas and 95 percent compaction under structures or track ballasts.
- D. Backfilling around concrete structures and for duckbanks and similar utilities shall conform to the applicable requirements of section 31 00 00, Earthwork.
- E. The imported backfill shall be placed and compacted to designated dimensions as specified in Sections 19-1.03 of the Caltrans Standard Specifications.
- F. The Asphalt paving on imported backfill shall conform to 32 12 16, Asphalt Concrete.

3.05 FIELD QUALITY CONTROL

- A. Comply with applicable requirements specified in Section 31 00 00 Earthwork.

END OF SECTION

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SECTION 330535

PROTECTION, REMOVAL AND ABANDONMENT OF UTILITY PIPES

PART 1 - GENERAL

1.01 DESCRIPTION:

- A. Work in this section consists of installation of new casing pipes, and removal and abandonment of existing utility pipes and facilities. All work will be performed at the locations and limits as shown on the plans and as directed by the Engineer.
- B. This section includes the requirements for the following work;
 - 1. Provide protection to existing public and private utilities that cross the proposed reinforced concrete box installation by installing a split steel casing and concrete encasement of utility pipes.

1.02 RELATED SECTIONS:

- A. SC-6, Contract Data Requirements
- B. SC-9, Delivery, Loading and Storage
- C. SC-10, Work Sequence Constraints
- D. SC-14, Hazardous Materials
- E. GC-34, Contractor's Work Area
- F. GC-43, Shop Drawings Product Data and Samples
- G. GC-44, Survey Requirements
- H. GC-51, Disposal of Materials
- I. GC-52, Protection of Completed Portions of Work
- J. GC-53, Cleanup
- K. GC-67, Differing Site Conditions
- L. GC-74, Warranty Work and Warranty
- M. Section 02 41 00, Demolition
- N. Section 31 00 00, Earthwork
- O. Section 33 05 25, Support and Protection of Utilities
- P. Section 33 05 28, Trenching and Backfilling for Utilities

1.03 REFERENCES:

- A. American Society for Testing Materials (ASTM):
 - 1. ASTM A 139 Grade B, Specification for Split Steel Casings
- B. City of Fremont –Standard Plans, and Standard Specifications
- C. Union Sanitary District –Standard Specifications 2006
- D. BART Facilities Standard – Criteria Civil – Utilities, Sections 1 through 5.
- E. AREMA - Section 5.3, Specification for Pipeline Conveying Non-flammable Substances.

1.04 REGULATORY REQUIREMENTS

- A. Regulatory requirements, which govern the Work of this Section, include the following governing codes:
 - 1. California Code of Regulations (CR), Title 8, Chapter 4, Subchapter 4 - Construction Safety Orders, and Subchapter 19 – Trench construction Safety Orders, for trench excavations of 5 feet or more in depth.
 - 2. California Code of Regulations, title 24, Part 2, California Building Code, Chapter 33, and Appendix Chapter 33, Excavation and Grading, for protection of the public.
 - 3. Alameda County Flood Control – Water Conservation District
 - 4. Regional Water Quality Control Board
 - 5. Alameda County Water District

1.05 SUBMITTALS:

- A. General: Conform to SC-6, Contract Data Requirements and GC-43, Shop Drawings, Product Data, and Samples for submittal requirements and procedures.
- B. Product data: Submit manufacturer’s product data for pipe casings (including hardware, angles, joints, clamps), casing seals, bedding, backfill and grouting materials.
- C. Shop drawings: Shop drawings shall conform to the submittal requirements of AREMA, the requirements of the public utility owners, and this Section.
 - 1. Provide shop drawings and written procedures describing in detail, the proposed method of installation and placement of the pipe casings, Contractor’s plan to prevent “freezing,” and methods of preventing pipe floatation and terminating grouting at the end of the casing.
 - 2. Provide shop drawings and written procedures describing in detail, the proposed method of removal and abandonment of existing longitudinal and transverse utility pipes, including utility supports and trench excavation, protection to existing structures, shoring and sheeting, capping and sealing existing facilities to remain in place, trench restoration, and any other work related to removal and abandonment work.

3. Shoring and bracing plans, calculations and details prepared by a Civil or Structural Engineer licensed in the State of California.
 4. Utility support details including support block, bracing to prevent pipe shifting or floatation, across or parallel to trench.
 5. Excavation supports at open trench areas, and shall conform to Section 33 05 25, Support and Protection of Utilities.
 6. Detailed locations, sizes, and depths of all open trench, pipe installation and backfill methods and procedures.
- D. Permits: Submit approved open trench permits from respective public utility owners.
- E. Qualification Personnel: Submit, 5 calendar days after notice of award, the name of the Split Casings and Open Trench subcontractor and the Project Superintendent with their qualifications and resume meeting the minimum requirements specified in these Technical Specifications for review and approval. No open trench work will proceed until the Owner approves the subcontractor and the Project Superintendent.
- F. Survey Data: Submit survey data obtained by a Surveyor licensed in the State of California.
- G. Schedules: Pipe installation schedule that include schedules of excavation and backfill operations.
- H. Specifications: Provide specifications of equipment to be used for each type of operation.
- I. Samples: Cut sheets of products to be used.
- J. Quality assurance/control submittals
1. Methods of Installation
 - a. Trenching and Backfilling Operation
 2. Test reports: Welding
 3. Certificates: Provide certificate of compliance for pipe casings, hardware or accessories, casing seals, bedding and backfill materials.
 4. Manufacturer's instructions: Provide manufacturer's installation procedures for each specified product to be used.
 5. Safety and Worker's Protection: Conform to SC-13, Safety Precautions, Programs and First Aid Requirements.
- K. Closeout Submittals: Conform to GC-63 Project Records.
- L. MCI/Verizon temporary relocation plan: Contractor shall submit a plan and design for spanning the Warren Ave. excavation during construction.

1.06 QUALITY ASSURANCE:

- A. Quality assurance shall conform to California Department of Transportation (Caltrans), Standard Specifications (2010), Section 11, Quality Control and Assurance, for quality assurance program.

1.07 DELIVERY, STORAGE AND HANDLING:

- A. Delivery, storage and handling shall conform to SC-9, Delivery, Unloading and Storage requirements and GC-51, Disposal of Materials, for disposal of materials. Disposal of hazardous soils and materials shall conform to GC-9, Hazardous Materials or Unusual Conditions.

1.08 PROJECT SITE CONDITIONS:

- A. Jobsite requirements: Refer to Geotechnical Report for soil boring information. Excavations in which products will be buried shall be dry.
- B. Existing conditions: Refer to GC-44, Survey Requirements and GC-67, Differing Site Conditions and Section 02 41 00, Demolition and Section 31 00 00, Earthwork.
- C. Pothole Information: Refer to Existing Utility drawings for pothole information of the existing utilities.
- D. Additional Pothole Information: After review of Contract Documents and if it is determined that additional pothole is required to verify depth and location of existing utilities, Contractor shall notify Engineer in advance and request for additional potholes be performed. Upon written approval of Engineer, Contractor shall perform the potholing work prior to excavation.
- E. Coordinate with and obtain permit from jurisdictional utility owner for use of water supply during construction. Payment associates with acquiring water for construction use shall be at Contractor's cost.
- F. Dewatering shall conform to the following:
 - 1. The Contractor shall obtain written approval of all de-watering operations (De-Watering Operations Plan) from Engineer prior to the start of these operations. The Contractor shall provide to Engineer a written dewatering plan which includes an estimate of the duration and quantity of the water to be removed during the de-watering operation. Sediment traps, sediment basins, or banker tanks shall be utilized to remove settleable solids from the water prior to disposal. Further filtration of the water following the use of sediment traps, sediment basins, or banker tanks may be required as directed by Engineer at the Contractor's expense. The plan shall also include details on the methods, equipment, and schedule (frequency) for testing of any water to be discharged to confirm that it meets requirements of these Contract Documents, State and Federal regulations, and the requirements of the Regional Water Quality Control Board.
 - 2. The Contractor shall contact the Regional Water Quality Control Board at (510) 622-2438 for approval and to receive a permit for any groundwater pretreatment process where discharges to a storm drain, creek, or watercourse are proposed.
 - 3. The Contractor shall contact the Union Sanitary District Environmental Compliance at (510) 477-7500 for approval and to receive a permit for any discharges into the sanitary sewer.

4. Water from de-watering operations may be disposed of into the City's storm drain system or sanitary sewer system with written approvals and/or permits from the utility owner or governing agency. Prior to disposal of any water from de-watering operations, the Contractor shall have the water analyzed by a qualified lab for the following constituent concentrations, and provide the lab results to Engineer. .
5. The Contractor shall note that periodic discharges from rainfall, blow-offs, surface, subsurface, pipe leakage, and groundwater can be expected at any time of the year, and will need to be pumped out as needed.
6. The Contractor shall furnish and install all or any sheet piling required and any other devices necessary to remove encountered water. Groundwater shall be removed by suitable means approved by Engineer, will prevent the groundwater from softening the trench bottom prior to backfilling with backfill material.

G. Trench and Backfill: Refer to the requirements of jurisdictional agencies.

1.09 SCHEDULING:

A. General

B. Coordination

1. The Contractor shall coordinate activities to assure efficient and orderly procurement, fabrication, construction, installation and testing/start-up of all parts of the work. This includes coordinating operations covered under different sections of the Contract Documents that are dependent on each other for proper installation and operation.
2. Where installation of one component depends on installation of other components before or after its own installation, activities shall be scheduled in the most appropriate sequence to obtain the most satisfactory installation.
3. The Contractor shall coordinate scheduling and timing of administrative procedures with other activities to avoid conflicts and to ensure orderly progress. Such activities include, but shall not be limited to:
 - a. Preparation of Construction Schedules.
 - b. Preparation and processing of submittals.
 - c. Attending Progress meetings.
 - d. Coordinating Project closeout activities.

C. Scheduling:

The schedule shall conform to the requirements in SC-23, Construction Progress Schedule.

1.10 WARRANTY:

A. General: Warranty shall conform to GC-74, Warranty Work and Warranty on Repaired or Replaced Parts.

1.11 MAINTENANCE AND WORK AREA:

- A. Work area and access: Contractor shall conform to GC-34, Contractor's Work Area. The Contractor shall not block any driveway or access to adjacent property owners or service road at any time during construction.

1.12 PROTECTION:

- A. Potholing:
1. The Contractor shall review available pothole information and field-verify all existing utilities within the limit of work (type, size, location and depth) prior to starting any excavation. The Contractor shall not proceed with underground installation until field verification related to existing utilities has been completed to the satisfaction of the Owner. The Contractor shall immediately notify the Owner of conflicts in which there is less than one foot of separation between the existing and proposed facility.
 2. The Contract Plans may not show all existing utilities within the limit of work area. The Contractor may be required by Engineer to perform additional potholing to verify existing utilities not shown on the Contract Plans. The Contractor shall chronologically number each pothole and paint the number of the pothole onto the pavement adjacent to the pothole. The Contractor shall record the number of the pothole and identify the pothole by station offset, depth, and type of utility encountered. These notes shall be given to Engineer at the end of each day.
 3. If existing utilities are not shown on the Contract Plans or not found to be within reasonable proximity as shown on the Contract Plans, the Contractor shall take all precautionary measures to protect existing facilities from damage and notify Engineer of his finding immediately.
 4. The Contractor shall bear full responsibility for all damages by contractor's operation and costs of repairs to existing utilities. Should any such utility be damaged during construction, all expenses of the restoration of the utility to its original service shall be borne by the Contractor, and no additional compensation will be made.
 5. Unless otherwise indicated on the Contract Plans or specified herein, the Contractor shall protect in place all water, gas and sewer lines; electrical, power and telephone conduits or structures; petroleum lines; utility service lines and other surface or subsurface structures of any nature that may be affected by the Work. If the Contractor fails to protect such facilities, the Owner reserves the right, if requested by the jurisdiction parties, to permit the jurisdiction parties to move or maintain the utility at the Contractor's expense. Should it become necessary in the performance of the Work to disconnect or reroute any underground utility due to a direct conflict with the new work, disconnection or rerouting will be paid for as extra work unless otherwise specified on the Contract Plans or Technical Specifications. If the utility is private-owned, it will be disconnected or rerouted by the private utility company involved.
 6. The right is reserved by the Owner, and by owners of public utilities and franchises, to enter upon any road, right-of-way, or easement for the purpose of maintaining their property and making necessary repairs or changes caused by this work.
 7. Backfill of potholes shall conform to Section 31 00 00, Earthwork.
- B. Trench Excavation and Protection: Conform to Section 31 50 00, Excavation Support and Protection, and the following:

1. The Contractor shall conform to the rules and regulations pertaining to construction safety established by the California Division of Industrial Safety (CAL-OSHA). The Contractor shall, before beginning any excavation or trench work 5 feet or more in depth, secure a permit "to perform Excavation or Trench Work" from the State of California, Division of Industrial Safety.
 2. In order to receive a permit "to perform Excavation or Trench Work", the Contractor must submit a detailed plan showing his proposed design for shoring, bracing or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches 5 feet or more in depth. If such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared by a registered Civil or Structural Engineer in the State of California.
 3. The Contractor shall file a copy of the permit "to perform Excavation or Trench Work" with Engineer at least five (5) days before the beginning of any excavation or trench work.
 4. The acceptance of the copy of the permit "to perform Excavation or Trench Work" shall in no way be construed to impose tort liability on the Owner, or any of its officers, employees or designated agents by reason of any damage to person, including death or property resulting from or arising out of the use of such plan, and the Contractor shall be fully responsible for any such damage, and the Contractor shall indemnify and hold harmless the Owner, its officers, employees or designated agents from any loss or liability resulting from the use of such plan.
 5. The permit, together with a copy of the approved plan for trench safety, shall be maintained on the Jobsite at all times.
 6. All bracings shall be adequate to protect and prevent movement, either horizontally or vertically, of existing utility lines not limited to water lines, storm lines, gas/petroleum lines, electrical and telephone conduits and any and all other underground or surface facilities within or adjacent to the excavation.
 7. Access to trenches shall be provided. Safe and suitable ladders shall be provided for all excavations four (4) feet and over in depth. The ladders shall project a minimum of two (2) feet above the top of the trench and one such ladder shall be provided for every 25 feet of open trench, as set forth in the rules, orders and regulations prescribed by the State of California Construction Safety Orders.
- C. Safety: All work shall conform to the requirements of the State of California, Division of Industrial Safety, OSHA and CAL-OSHA. The Contractor's attention is directed to "Title 8 – Tunnel Safety Orders of the State of California".
1. Prior to construction, the Contractor shall conduct a pre-job Safety Conference with representatives from the Owner, subcontractor, Union Pacific Railroad and CAL-OSHA. This will be the responsibility of the Contractor to coordinate and organize. Meeting minutes shall be prepared by the Contractor and distributed to all parties. Costs incurred due to coordinating work, organizing a meeting with these representatives shall be borne by the Contractor at no additional charges to the Owner.
 2. Underground construction shall be performed in such a manner so as to minimize ground movement in front of and surrounding the excavation and to prevent subsidence of ground surface, structure, and utilities above and in the vicinity of the crossing.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS:

- A. Pipe casings: Pipe casings shall be manufactured from steel conforming to ASTM Grade 2 with minimum yield strength of 35,000 psi before cold forming. Pipe casings for all existing utility lines that cross the tracks shall be smooth steel split casings, two-section hinged or securely bolted, either coated or cathodically protected, and shall meet the AREMA and ASTM thickness requirements for steel casing. Pipe size, length and minimum pipe wall thickness shall be as shown on the plans. All circular joints shall be welded. Manufacturer: Ironhedllc at 1-866-476-4510 (www.ironhedllc.com), Victor Pipe and Steel, Inc. at 1-800-264-6315 (www.victorpipe.com), IPSCO at 1-630-810-4737 (www.ipSCO.com), or approved equal products.
- B. Casing Seals: Casing seals shall be made of 1/8" synthetic rubber, secured with stainless steel band with non-magnetic worm gear mechanism. Manufacturers: Advanced Products and Systems, Inc at 1-337-233-6116 (www.apsonlune.com), The BWM Company (www.bwmcompany.com), or approved equal products.
- C. Cathodic Protection and Test Station: Required for all steel split casings if pipes not coated.
- D. Trench bedding and backfill materials: Conform to ASTM C-33. As specified by the jurisdictional agencies in their respective Standard Drawings and/or Specifications, and as modified in the plans for trench restoration.
- E. Outside and Filled material: After the casing is installed and securely blocked to prevent flotation, fill the intervening annular space with cement slurry, using pumping equipment in one continuous operation.

2.02 EXISTING FACILITIES:

- A. Removal and Restoration of Existing Tracks:
 - 1. Protect existing facilities such as existing structures, foundations and footings, fencing, tracks, and utility pipes from damage during clearing and grubbing and excavation. Take all precautionary measures to make sure existing facilities are not disturbed or damaged by contractor's operation. Any damage due to contractor's negligence shall be repaired or replaced at contractor's cost.

2.03 FABRICATION

- A. All products shall be factory fabricated. Field fabrication shall not be acceptable, unless otherwise approved in writing by Engineer or utility owner.
- B. Contractor shall verify sizes of existing pipes to receive casings before ordering and fabricating pipe casings.

PART 3 - EXECUTION

3.01 MAINTAINING EXISTING SERVICES:

- A. Existing pipe crossings: Existing utilities shall remain in service 24 hours a day during casing installation. No interruption to the services will be permitted.

3.02 PREPARATION:

- A. Clear and grub work area conforming to Section 31 11 00, Clearing and Grubbing.
- B. Maintain a neat appearance at the work site. Debris developed during construction shall be disposed of concurrently with its generation. Stockpiling of debris during construction shall not be allowed, and shall be removed from the project Jobsite by the end of each working day.
- C. Maintenance and Protection of Excavations: Temporary support, adequate protection and maintenance of all underground and surface utilities, structures, drains, sewers and other obstructions encountered in the progress of the Work shall be furnished and paid for at Contractor's expense. Contractor shall take all reasonable precautions to prevent movement of the sides of excavation area. Contractor shall protect all excavations from surface water.

3.03 REMOVAL OR ABANDONMENT OF EXISTING FACILITIES:

- A. General: Removal or abandonment of existing utilities as shown on the Contract Plans shall conform to Division 02, Existing Conditions and Division 31, Earthwork of these Technical Specifications.
- B. Existing Private Utilities:
 - 1. Conform to the requirements of Engineer, and Alameda County Water District for procedures and requirements in removing abandoned facilities.
 - 2. Testing and remediation of contaminated soil, if necessary, shall conform to the requirements and local, state and federal regulations.
 - 3. Conform to California Department of Transportation (Caltrans), Standard Specifications (2010) for removal, disposal and stockpiling of contaminated soil.

3.04 INSTALLATION OF PIPE CASINGS:

- A. Split Steel Casing: The Contractor shall install split steel casings for various existing public utility crossings under the proposed storm drain culvert. Installation of steel casing shall be done by open trench method, conforming to the requirements of the Standard Specifications, these Contract Specifications, Union Sanitary District Standard Specifications and details shown on the Contract Plans.
- B. Installation:
 - 1. Field verify location and depth of the existing utility line to receive casing.
 - 2. Excavate pipe trench in accordance with Section 33 05 28, Trenching and Backfilling for Utilities. Trenches shall be excavated either by hand or by machine, beginning at the outlet and proceeding upgrade. All trenches shall be excavated vertically and shall be of open construction. Hand dig trench as it gets closer to existing pipe.
 - 3. Provide support to existing utility line in accordance with Section 33 05 25, Support and Protection of Utilities. Contractor shall brace and support all existing utilities crossing the trench, as required. All existing pipes, conduits or ducts which are crossing or partially trenched, shall be rigidly supported across the trench by treated redwood timbers as directed by Engineer unless otherwise shown on the Contract Plans or indicated elsewhere in these Technical Specifications. During backfilling operations, redwood timbers used for support shall be removed and disposed of.

4. Contractor may encounter pea gravel, sand or quarry waste in all existing trenches. Contractor shall protect the trench from cave-in during trenching. Any damage to the existing facilities caused by trench failure or cave-in shall be restored by the Contractor at no additional cost to the City. These restoration methods shall be as specified by Engineer. This may include removal of collapsed materials, rebuilding the trench and full pavement section, or slurry cement backfill as specified in Section 31 00 00, Earthwork.
5. All trenches shall be of sufficient width to provide free working space on each side of the pipe and in no case shall such space be less than six (6) inches or shall it be wider than $1\frac{1}{2}$ the diameter plus 12 inches unless otherwise shown on the plans. Where bracing and shoring is necessary, an additional width as directed by Engineer will be allowed. In all cases, there shall be sufficient space between the pipe and the sides of the trench to thoroughly backfill and compact around the pipe. Contractor may propose in writing, for Engineer's approval, additional trench width beyond that shown on the Contract Plans.
6. Unless otherwise approved by the Engineer or utility owner, no more trench shall be opened than can be properly and completely backfilled in one day. If approved, the open trench shall be covered with steel plates and properly fenced to protect public from injury.
7. In firm ground the trench shall be cut no deeper than as shown on the plans, and shall be cut to its true line and grade. If the trench should be cut deeper than necessary, it shall be brought up to grade by crushed rock or material approved by Engineer and compacted.
8. Place split steel casing as per manufacturer's recommendation. Alternating sections shall be installed so that the existing pipe remains fully supported on the existing bedding. Only as much length of pipe shall be exposed as necessary to install the bottom segment of the casing section. The bottom section of existing pipe and casing shall be fully supported. Extreme care shall be taken to prevent damage to the existing pipe receiving casing.
9. No pipe shall be laid until contractor's independent testing agency inspects and approves the condition of the bottom of the trench.
10. Where applicable, welding of the transverse joint between new and existing casing, conforming to the requirements of California Department of Transportation (Caltrans), Standard Specifications (2010).
11. Following assembly, surfaces of bolts, nuts, washers, and welded surfaces shall be primed and coated. Install casing seals or tie to existing casing where applicable, conforming to AREMA and BFS requirements.
12. Before backfilling, the entire surface of the assembled casing shall be fully inspected and any damage to the coating repaired. The initial lift up to 6 inches over and around the side of casing shall be carefully placed.
13. Place bedding material, meeting the requirements of Section 33 05 28, Trenching and Backing for Utilities, at trench bottom, level in one continuous layer not exceeding six inches in compacted depth.
14. Annular space: Spacing between pipe casing and existing pipe shall be filled with lean grout. Lean grout shall consist of one-half part Portland Cement, one part sand, and sufficient water to produce a workable mixture; or one to one neat cement mix (no sand). Grouting pressure is to be controlled so as to avoid deformation of the pipe and/or avoid movement of the surrounding ground but in any case should not exceed 80% of the

overburden pressure or be less than 1 psi. Sand for the grout mixture to be placed outside the pipe shall be of such fineness that 100% will pass a No. 8 sieve and not less than 35% will pass a No. 50 sieve.

15. The control of water shall be the responsibility of the Contractor. The construction site, particularly the bottom of the trench, shall be de-watered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work.
16. Drainage of trench water through the pipeline under construction shall be prohibited.

3.05 CONSTRUCTION REQUIREMENTS:

- A. Tolerances: Pipe casings shall be installed true to line and grade. The tolerance for pipe slopes is 0.005+/-.
- B. Limit of Work Schedule: Conform to the requirements of jurisdictional and regulatory agencies for limit of work schedule.
- C. Interface with other work: Contractor shall coordinate work and schedule with other contractors working in the same project limit of work and shall conform to SC-10, Work Sequence & Constraints.
- D. All required water, all work and materials required for obtaining, pumping, transporting and applying and otherwise disposing of said water shall be in an approved manner and shall be performed by, and at the expense of the Contractor and no extra or separate compensation will be made thereof.

3.06 REPAIR/RESTORATION:

- A. Contractor shall restore work area to its original condition prior to performing work. This includes repairing or replacing portion of fences, walls, embankment, pavement, and any other facilities.

3.07 CLEANING:

- A. General: Cleaning shall conform to GC-51, Disposal of Materials, GC-52, Protection of Completed Portions of Work and GC-53, Cleanup.
- B. Contractor shall provide a final clean-up of entire project site prior to scheduling the final walk-through for acceptance of the work.
- C. Disposal of surplus material: Contractor shall dispose of all surplus excavated materials not needed for fills or other designated purposes. All material deemed unsuitable by Engineer shall be disposed of properly and replaced with approved materials.
- D. Disposal of hazardous material: Conform to SC-14 and GC-9, Hazardous Material or Unusual Conditions. This includes but not limited to the excavated contaminated soil during the trench excavation work.

3.08 INSPECTION

- A. All materials furnished and work done under this contract will be subject to inspection. The Contractor shall notify Engineer forty-eight (48) hours in advance of any work to be done, in order that inspection may be provided. The Contractor shall inform Engineer at least 72 hours in advance of the work as to the source of all materials proposed to be used in the work.

Samples of materials shall be made available for testing as required by Engineer, prior to starting work and during the course of the work. Work done in the absence of an inspector, without said written permission, shall be subject to rejection.

- B. Engineer shall have access at all times to all parts of the shop or plant where material under his or her inspection is being manufactured. When required, the Contractor shall notify Engineer in sufficient time in advance of the manufacture or production of materials to be supplied under this contract, in order that the Owner may arrange for mill or factory inspection and testing of same. Any materials shipped by the Contractor from the factory prior to having satisfactorily passed such testing and inspection by the Owner's representative, or prior to the receipt of notice from said representative that said materials have satisfactorily passed such testing and inspection, or that such testing and inspection will not be required, shall not be used in the Work.
- C. The Contractor shall have no cause for claim against the Owner for delays involved in the testing of materials or the evaluation of such tests and no compensation will be made therefore.
- D. If, in the opinion of Engineer, work is not being done in accordance with the Contract Documents, written notice shall be given to the Contractor or its authorized agent. Written notice to any supervisors or agent in charge of any portion of the Work in the absence of the Contractor, shall be considered as notice to the Contractor.
- E. Work that is defective in its construction, or deficient in any of the requirements of these specifications, shall not be considered as accepted in the event of the failure of any employee of the Owner or inspector connected with the Work, to point out said defects or deficiency during construction. The Contractor shall correct any imperfect work whenever discovered. If he or she refuses or neglects to replace defective work, it may be replaced by the Owner, after notice to the Contractor and his or her sureties, at the expense of the Contractor and the Contractor and his or her sureties shall be liable therefor.
- F. Contractor's Request for Final Inspection: The Contractor shall request Engineer, in writing, to conduct a final inspection when the Contractor considers the Work is complete.
- G. A Final Inspection will be scheduled within ten (10) working days and conducted by Engineer, if the Owner deems the Work complete. If the Owner does not accept that the contract work as complete, Owner will decline to schedule a Final Inspection, and advise the Contractor the reason for not accepting the work as being complete. When the Contractor again deems the work to be complete, a new written request shall be submitted.
- H. The Final Inspection will be conducted by Engineer. As a result of the inspection, the Owner will advise the Contractor of any work that must be completed or corrected before Acceptance, in the form of a Punchlist.
- I. Prerequisites for Acceptance:
 - 1. Completion of Punchlist.
 - 2. Submittal of final payment requests, with lien releases.
 - 3. Submittal of Record Drawings.

END OF SECTION 33 05 35