

SECTION 02 41 00

SITE DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00 - Construction Facilities and Temporary Controls.
3. Section 01 50 13 - Construction Waste Management and Disposal.
4. Section 31 00 00 - Earthwork.
5. Section 31 13 16 - Tree Protection.

1.02 REGULATORY REQUIREMENTS

- A. Conform to applicable jurisdictional authority regulations and codes for disposal of debris.
- B. Coordinate clearing Work with utility companies
- C. Maintain emergency access ways at all times.
- D. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including contaminated soils, hazardous material transformers, and similar materials or components.

1.03 SUBMITTALS:

- A. Schedule: Submit a detailed sequence of demolition and removal work, including dates for shutoff, capping, and continuance of utility services.
- B. Procedures: Submit written procedures documenting the proposed methods to be used to control dust and noise.

1.04 EXISTING CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- B. Conduct demolition to minimize interference with adjacent structures or items to remain. Maintain protected egress and access at all times.

1.05 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Safety Precautions Prevent damage to existing elements identified to remain or to be salvaged, and prevent injury to the public and workmen engaged on site. Demolish roofs, walls and other building elements in such manner that demolished materials fall within foundation lines of building. Do not allow demolition debris to accumulate on site. Pull down hazardous work at end of each day; do not leave standing or hanging overnight, or over weekends.
 - 1. Protect existing items which are not indicated to be altered. Protect utilities designated to remain from damage.
 - 2. Protect trees, plant growth, and features designated to remain as final landscaping as shown on drawings.
 - 3. Protect benchmarks from damage or displacement.
- D. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.
- E. Fire Safety: The contractor shall conform to chapter 33 of the California Fire Code (CFC), "Fire Safety During Construction and Demolition", at all times during the construction process. A copy of this chapter can be provided.
- F. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- G. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- H. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

PART 2 - PRODUCTS

Not Used

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine conditions of work in place before beginning work, report defects.
- B. Report existence of hazardous materials or unsafe structural conditions.

3.02 PREPARATION

A. Scheduling:

- 1. General: Coordinate and schedule demolition work as required by the Owner and as necessary to facilitate construction progress.

B. Hazardous Materials:

- 1. General: Identify chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations, and notify such jurisdictional agencies as may be required. Collect and legally dispose of such materials at official disposal locations away from the site.
- 2. Asbestos: If asbestos or materials containing asbestos are encountered, stop work immediately and contact the Owner. Do not proceed with demolition until directed by Owner.

C. Utility and Service Termination

- 1. Locate and identify existing utility, service and irrigation system components affected by work of this contract. Review existing record drawings, conduct site investigations, contact Underground Service Alert and other qualified cable/pipe/line locator services, and implement all other means necessary to define the location of underground systems.
- 2. Prior to beginning any demolition, properly disconnect all water, gas and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.
- 3. Prior to demolition or disconnect, obtain Owner's approval that such system does not impact facilities or systems beyond the extent of this contract.
- 4. Mark location of disconnected systems. Identify and indicate stub-out locations on Project Record Documents.

D. Verify that existing plant life and features designated to remain are tagged or identified.

- 1. The Architect will mark the features, trees, and shrubs to remain within the construction area. Contractor shall not commence clearing and grubbing operations until authorized by the Owner and all protective measures are in place.

E. Coordinate the time and duration of all system disconnects with Owner.

3.03 DEMOLITION

A. General Requirements

1. Clear areas required for access to site and execution of Work, including pavements, structures, foundations, vegetation, trash and debris.
2. Coordinate with Owner the time of day and route to remove demolished materials from premises.
3. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
4. Remove all buried debris, rubble, trash, or other material not deemed suitable by the Geotechnical Engineer.
5. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with specified fill material.

B. Fixture and Equipment Removal:

1. Remove existing fixtures and equipment as identified and shown on drawings and required by Architect.
2. Verify all service connections to fixtures and equipment designated for removal have been properly disconnected.
3. Remove all conductors from conduit at all abandoned circuits.

3.04 UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

A. Where crossing paths and potential points of interference with existing utility services are shown or can be reasonably inferred from surface conditions or evidence of subsurface systems, such as meter boxes, vaults, relief vents, cleanouts and similar components.

1. Review all contract documents showing crossing paths and potential points of interference.
2. Pothole or determine by other means the accurate depth and location of such utilities.
3. Incorporate all costs required to complete work under this contract, including additional trenching, re-routing of existing and new utilities, and all means necessary to construct work under this contract.
4. No additional cost to the Owner will be allowed for work necessary to accommodate utility conflicts where such crossing paths are shown on contract drawings or can be reasonably inferred from surface conditions or components.

B. Remove all conductors from conduit at all abandoned electrical circuits.

C. Seal off ends of all piping, drains and other components as directed by Architect and serving utility.

D. Where necessary to maintain service to existing utility and building systems, relocate or redirect all conduit and conductors, piping, drains, and associated system components.

1. Re-circuit all electrical as required.
2. Re-circuit all landscape irrigation valving and control systems as required.

3. Temporarily terminate landscape system components in approved boxes or with approved caps, suitable for re-connection or extension.
4. Extend or otherwise modify all site drainage systems, including catch basins, drain inlets and piping. Fine grade to maintain proper drainage flow pattern to drains.

E. Demolish structure in an orderly and careful manner.

1. Use of explosives prohibited.

3.05 SITE PAVEMENT REMOVAL

A. Remove sidewalk and curb where required for new construction as specified and as indicated on the Drawings.

1. Remove all paving by saw-cutting.
2. Remove concrete paving and curbing at locations shown on drawings. Locate closest adjacent expansion or weakened plane joint to define start of removal or saw-cutting.

B. Remove asphalt concrete paving areas where required for new construction as specified and as indicated on the Drawings.

1. Remove all paving by saw-cutting.
2. Remove paving assembly as required to expose subgrade.

3.06 LANDSCAPE AND IRRIGATION SYSTEMS DEMOLITION AND RENOVATION

A. Clearing, grubbing, and planting demolition.

1. Remove grass and grass roots to a minimum depth of two inches below existing grade.
2. Remove all shrubs, plants and other vegetation within the area of the work unless designated to remain. Grub and remove all roots of all vegetation to a depth of 24 inches below existing grade.
3. Remove only those trees which are specifically designated for removal, or as shown on the drawings, within the construction area. Remove all stumps. Remove root ball and root systems larger than 1 inch in diameter to a depth of two feet below existing or finished grades, whichever is lower and a minimum of five feet beyond the edge of paving, structure, wall or walkway.
4. Hand cut existing tree roots over 1 inch in diameter as necessary for trenching or other new construction, apply multiple coats of emulsified asphalt sealant especially made for horticultural use on cut or damaged plant tissues to cut faces and adjacent surfaces. Cover exposed roots with wet burlap to prevent roots from dying out until backfilling is complete.
5. Disking and mixing of vegetation, trash, debris, and other deleterious materials with surface soils prior to grading is not permitted.
6. Remove all buried debris, organic material, rubble, trash, or other material not deemed suitable by the Geotechnical Engineer.
7. Fill all voids or excavations resulting from clearing, demolition, or removal of vegetation with fill material in compliance with Section 31 00 00.
8. Selected equipment of such sizes and capacities that the existing environment is disturbed as little as possible, and to afford ease of mobility within limited and relatively confined work areas. Make every effort to preserve the topography in its natural state.

9. Keep drains, catch basins, surface drainage courses and related drainage system components clear of debris and construction materials.
10. Remove irrigation piping and appurtenances as necessary within area of work, unless noted otherwise to remain. Replace irrigation piping and appurtenances to irrigate new and/or existing landscaping. Contractor shall be responsible for temporary landscape irrigation until such time that irrigation system is restored and operational.

3.07 DISPOSAL

Demolished materials become property of the Contractor and shall be removed from premises, except those items specifically listed to be retained by Owner.

- A. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority.
- B. It is recommended that all materials that are of a recyclable nature, be transported to a suitable legal recycling facility instead of a dump or refuse facility (unless they are one-in-the same).
- C. Burning and Burying of Materials: NOT ALLOWED.
- D. Haul Routes:
 1. Obtain permits as required by jurisdictional agencies. Establish haul routes in advance, post flagmen for the safety of the public and workmen.
 2. Keep streets free of mud, rubbish, etc.; assume responsibility for damage resulting from hauling operations; hold Owner free of liability in connection therewith.
- E. Remove demolished materials and debris from site on a daily basis.

3.08 CLEANING

- A. Upon completion of work of this Section promptly remove from the working area all scraps, debris.
- B. Clean excess material from surface of all remaining paved surfaces and utility structures.
- C. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place concrete work including, but not limited to, the following:
 - 1. Concrete materials and mixture design.
 - 2. Formwork.
 - 3. Reinforcement.
 - 4. Placement procedures and finishes.

1.02 RELATED SECTIONS

- A. Section 04 22 00 – Concrete Unit Masonry.
- B. Divisions 21-23 – Mechanical Sections, as applicable to the Project.
- C. Divisions 25-28 – Electrical Sections, as applicable to the Project.
- D. Section 31 00 00 – Earthwork.

1.03 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. ACI publications PRC-221, PRC-302.1, PRC-302.2, PRC-304, PRC-305, PRC-306, and PRC-309 contain recommended practices for concrete work. Submit any proposed deviations from these recommendations to Architect for review prior to commencing concrete work.
- D. Referenced Standards:
 - 1. AASHTO M182 – Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.
 - 2. ACI SPEC-117 – Specification for Tolerances for Concrete Construction and Materials.
 - 3. ACI PRC-221 – Guide for Use of Normal Weight and Heavyweight Aggregates in Concrete.
 - 4. ACI SPEC-301 – Specifications for Structural Concrete.
 - 5. ACI PRC-302.1 – Guide for Concrete Floor and Slab Construction.

6. ACI PRC-302.2 – Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
7. ACI PRC-304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete.
8. ACI PRC-305 – Guide to Hot Weather Concreting.
9. ACI SPEC-305.1 – Standard Specification for Hot Weather Concreting.
10. ACI PRC-306 – Guide to Cold Weather Concreting.
11. ACI SPEC-306.1 – Standard Specification for Cold Weather Concreting.
12. ACI PRC-309 – Guide for Consolidation of Concrete.
13. ACI CODE-318 – Building Code Requirements for Structural Concrete and Commentary.
14. ACI PRC-347 – Guide to Formwork for Concrete.
15. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
16. ASTM A706/A706M – Standard Specification for Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
17. ASTM A1064/A1064M – Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
18. ASTM C31/C31M – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
19. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
20. ASTM C39/C39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
21. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete.
22. ASTM C109/C109M – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
23. ASTM C114 – Standard Test Methods for Chemical Analysis of Hydraulic Cement.
24. ASTM C138/C138M – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
25. ASTM C143/C143M – Standard Test Method for Slump of Hydraulic Cement Concrete.
26. ASTM C150/C150M – Standard Specification for Portland Cement.
27. ASTM C157/C157M – Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
28. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete.
29. ASTM C172/C172M – Standard Practice for Sampling Freshly Mixed Concrete.
30. ASTM C231/C231M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
31. ASTM C260/C260M – Standard Specification for Air-Entraining Admixtures for Concrete.
32. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

- 33. ASTM C494/C494M – Standard Specification for Chemical Admixtures for Concrete.
- 34. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- 35. ASTM C881/C881M – Standard Specification for Epoxy Resin Base Bonding Systems for Concrete.
- 36. ASTM C928/C928M – Standard Specification for Packaged, Dry, Rapid Hardening Cementitious Materials for Concrete Repairs.
- 37. ASTM C939/C939M – Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
- 38. ASTM C989/C989M – Standard Specification for Slag Cement for Use in Concrete and Mortars.
- 39. ASTM C1017/C1017M – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
- 40. ASTM C1059/C1059M – Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
- 41. ASTM C1064/C1064M – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
- 42. ASTM C1077 – Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- 43. ASTM C1107/C1107M – Standard Specification for Packaged Dry, Hydraulic Cement Grout (Nonshrink).
- 44. ASTM D4397 – Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
- 45. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- 46. Concrete Reinforcing Steel Institute (CRSI) – Manual of Standard Practice. 27th edition.
- 47. ISO/IEC 17025 – General Requirements for the Competence of Testing and Calibration Laboratories (formerly ISO/IEC Guide 25-1990 and ASTM E548).
- 48. NRMCA Quality Control Manual – Section 3, “Plant Certification Checklist.”

1.04 SUBMITTALS

- A. General: Submit in accordance with Division 01.
- B. Product Data: Submit manufacturer’s descriptive literature and product specification for each product. Include manufacturer’s written instructions and installation procedures.
- C. Drawings: Submit concrete pouring plan showing proposed locations of construction and control joints for Architect’s review and acceptance, prior to concrete placement.
- D. Design Mixtures: For each concrete mixture.

- E. Certificates:
 - 1. Manufacturer's certification that materials (cementitious materials, aggregates, and admixtures) conform to Specifications.
- F. Concrete Placement Record: Keep a record on site including time and date of concrete placing for each portion of the structure for the duration of the project. Record additional information not included in batch ticket such as admixtures added at the job site. Make records available to Architect and DSA for review. Submit record to Architect at project completion.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Concrete Supplier: Firm specializing in products specified in this Section with a minimum five years documented experience; successfully supplying similar materials (design, content, and performance) as specified in this Section.
 - 2. Concrete Batch Plant: Complies with requirements of ASTM C94 and is currently certified per NRMCA Plant Certification Checklist – Section 3 or other certification acceptable to Architect and DSA.
 - 3. Contractor's Design Laboratory: Under the direction of civil engineer licensed by the State of California; conforming to ASTM E329 and ASTM C1077.
 - 4. Independent Testing Laboratory: Conforming to ASTM E329, ASTM C1077, and ISO/IEC 17025, acceptable to Architect and.
- B. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- C. Product Substitutions: Comply with requirements of Division 01.

1.06 REGULATORY REQUIREMENTS

- A. Structural Tests and Inspections: Refer to DSA Structural Tests and Inspection Sheet (Form DSA-103).
- B. Regulatory Requirements: Conform to requirements of 2022 California Building Code (CBC), Chapter 19A, "Concrete", Chapter 17A "Special Inspections and Tests", and as follows:
 - 1. Materials:
 - a. Cementitious Materials: CBC Chapter 19A, Section 1903A "Specifications for Tests and Materials" and Section 1910A.1 "Cementitious Material".
 - b. Batch Plant Inspection: CBC Section 1705A, Paragraph 1705A.3.3 "Batch Plant Inspection".
 - 2. Quality:
 - a. Composite Construction Cores: CBC Section 1910A, Paragraph 1910A.4 "Composite Construction Cores".
 - 3. Inspection: CBC Chapter 17A, Section 1705A "Required Special Inspections and Tests" Article 1705A.3 "Concrete Construction", as applicable.
 - a. Batch Plant Weighmaster Inspection: CBC Section 1705A, Paragraph 1705A.3.3 "Batch Plant Inspection".
 - 4. Formwork: Conform to ACI PRC-347 for design, fabrication, erection, and removal of forms.

5. Steel Reinforcement:
 - a. Perform work in accordance with CRSI Manual of Standard Practice; ACI SPEC-301; and 2022 California Building Code (CBC) Chapter 17A "Special Inspections and Tests", and Chapter 19A "Concrete", and as follows:
 - 1) Steel Reinforcement, Tests and Materials: CBC Section 1903A "Specifications for Tests and Materials".
 - 2) Anchorage: CBC Section 1905A.1.8.
 - 3) Reinforcing Bar Welding: Per Section 1705A, Table 1705A.3 "Required Special Inspections and Tests of Concrete Construction".
 - b. Structural Testing for Seismic Resistance: Perform tests for seismic resistance as required by CBC Chapter 17A, Section 1705A.14 "Testing for Seismic Resistance" and Paragraph 1705A.14.1 "Structural Steel".
- C. Comply with ACI SPEC-301, "Specification for Structural Concrete", including the following sections, unless modified by requirements in the Contract Documents.
 1. "General Requirements."
 2. "Formwork and Formwork Accessories."
 3. "Reinforcement and Reinforcement Supports."
 4. "Concrete Mixtures."
 5. "Handling, Placing, and Constructing."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Division 01.
- B. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- C. Store cement and other cementitious materials in weathertight buildings, bins, or silos which exclude moisture and contaminants and keep building materials completely separated.
- D. Arrange and use aggregate stockpiles in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Do not store aggregates directly on ground unless a sacrificial layer is left undisturbed.
- E. Refer to manufacturers' product data sheets for recommended shelf life and storage conditions for admixtures.
- F. Clearly and accurately label materials after containers have been opened.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

- A. Manufacturers and products specified in this Section are listed to establish minimum quality and performance requirements.
- B. Substitutions: Comply with requirements of Division 01.

2.02 FORMWORK

- A. Furnish formwork and formwork accessories according to ACI PRC-347.

2.03 STEEL REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60, low-alloy deformed steel bars.
- B. Reinforcing Steel Indicated to be Welded: ASTM A706/A706M, Grade 60, low-alloy deformed steel bars.
- C. Plain Steel Wire (for Spiral Reinforcement): ASTM A1064.
- D. Tie Wire: Black annealed steel wire; No. 16 gauge.

2.04 CONCRETE MATERIALS

A. Cementitious Materials:

1. Cement: ASTM C150, Type II, low alkali (equivalent alkalis ($\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$) no more than 0.6 percent per ASTM C114), gray.
 2. Supplementary Cementitious Materials (SCM):
 - a. Fly Ash: ASTM C618, Class F. Class C is not permitted.
 - b. Slag Cement: ASTM C989, Grade 100 or Grade 120.
- B. Aggregates: Aggregates used in concrete shall have a combined aggregate distribution similar to the aggregates used in the concrete represented by field test data or used in trial mixtures. Fine and coarse aggregates: ASTM C33. Low-shrinkage producing coarse aggregates per ACI 221R; manufactured from 100 percent crushed aggregates and uniformly graded as follows:

Sieve Number or Size in Inches	Percent Retained by Weight		
	1-1/2 inch Max.	1 inch Max.	3/4 inch Max.
2 inch	0-5	–	–
1-1/2 inch	0-8	0-5	–
1 inch	8-18	0-8	0-5
3/4 inch	8-18	8-18	0-8
1/2 inch	8-18	8-18	8-18
3/8 inch	8-18	8-18	8-18
No. 4	8-18	8-18	8-18
No. 8	8-18	8-18	8-18
No. 16	8-18	8-18	8-18
No. 30	8-18	8-18	8-18
No. 50	0-18	0-18	0-18
No. 100	0-8	0-8	0-8
No. 200	0-8	0-8	0-8

1. Maximum Nominal Size of Coarse Aggregate: CBC Section 1903A "Specifications for Tests and Materials," and as follows:
 - a. 1/5 the narrowest dimension between sides of forms,
 - b. 1/3 depth of slab, or
 - c. 3/4 the minimum clear spacing between individual reinforcing bars.
2. Aggregate sources shall not contain any alkali-silica reactive material in accordance with ASTM C33, Appendix XI.

C. Water: Potable and complying with ASTM C94/C94M.

2.05 ADMIXTURES

A. General:

1. Manufacturer certified to contain chlorides.
2. Compatible with other admixtures and cementitious materials in the concrete mix.
3. Obtain Architect's and DSA's written acceptance prior to use of admixtures. Use admixtures according to manufacturer's written instructions.

B. Acceptable Manufacturers:

1. Master Builders Solutions, Cleveland, OH; 800-228-3318 or 800-433-9517, www.master-builders-solutions.com.
2. Grace Construction Products, Cambridge, MA; 866-333-3726, www.na.graceconstruction.com.
3. The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
4. Sika Corp., Lyndhurst, NJ; 800-933-7452, www.sikaUSA.com.
5. Or accepted equal.

C. Air Entraining Admixtures: ASTM C260.

D. Chemical Admixtures:

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Set Accelerating: ASTM C494/C494M, Type C or Type E.
4. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
8. Shrinkage Reducing: ASTM C157/C157M.

2.06 CURING MATERIALS

A. General:

1. Comply with regulations of the California Air Resources Board and the local Air Pollution Control/Air Quality Management District. VOC limit: 350 g/L.

2. Verify compatibility with subsequent adhesives and coatings before application; furnish Manufacturer's certificate of compatibility. Coordinate with related Sections.
- B. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- C. Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 ounces per square yard when dry.
- D. Waterproof Sheet Materials for Curing: ASTM C171 and as follows:
1. Curing paper consisting of two sheets of kraft paper adhered together with a bituminous material with embedded cords or strands of fiber running in both directions not more than 1-1/4 inches apart.
 - a. Tensile strength in machine direction: Thirty foot-pounds per inch of width minimum.
 - b. Tensile strength in cross direction: Fifteen foot-pounds per inch of width minimum.
 2. Polyethylene film: ASTM D4397; minimum six mil thickness.
 3. White burlap-polyethylene sheeting: Consisting of burlap weighing not less than nine ounces per square yard extrusion coated on one side with at least four mil white opaque polyethylene sheet.
- E. Water: Potable.
- F. Curing Compound:
1. Water-emulsion, dissipating resin based; meets or exceed ASTM C309, Type 1, Class B.
 - a. Acceptable Products:
 - 1) Kurez DR-100 by The Euclid Chemical Co.
 - 2) 1100 by W. R. Meadows, Inc.
 - 3) US SPEC Maxcure Resin Clear by US Mix Products Co.
 - 4) Or accepted equal.
- G. Surface Retarder: Water soluble liquid, formulated to retard wet surface of mortar in concrete.
1. Acceptable Products:
 - a. MasterFinish EA by Master Builders Solutions.
 - b. Sure Etch Series by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 - c. Rugasol-S by Sika Corp., Lyndhurst, NJ; 800-933-7452, www.sikaUSA.com.
 - d. Or accepted equal.

2.07 GROUTING, BONDING, AND PATCHING MATERIALS

A. Grout:

1. Non-shrink Grout: ASTM C1107, non-metallic aggregate grout; 7000 psi minimum 28-day compressive strength at fluid water ratio per ASTM C939.
 - a. Acceptable Products:
 - 1) Masterflow 928 by Master Builders Solutions, Cleveland, OH; 800-228-3318 or 800-433-9517, www.master-builders-solutions.com.
 - 2) NS Grout, Hi-Flow Grout, or Euco Pre-Cast Grout by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.

- 3) US SPEC MP Grout by US Mix Products Co., Denver, CO; 800-397-9903, www.usmix.com.
 - 4) Or accepted equal.
2. Non-shrink Drypack Grout: Non-shrink, natural aggregates, 7000 psi minimum 28-day compressive strength.
 - a. Acceptable Products:
 - 1) MasterFlow 100 by Master Builders Solutions, Cleveland, OH; 800-228-3318 or 800-433-9517, www.master-builders-solutions.com.
 - 2) Dry Pack Grout by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 - 3) Sealtight Pac-it by W.R. Meadows, Inc., Hampshire, IL; 800-342-5976, www.wrmeadows.com.
 - 4) Or accepted equal.
- B. Bonding Materials:
1. Bonding Agent/Admixture:
 - a. Interior or exterior applications: Acrylic or SBR, latex cement bonding agent/admixture; non-re-emulsifiable; meets or exceeds ASTM C1059, Type II.
 - 1) Acceptable Products:
 - a) Akkro-7T, Flex-Con or SBR Latex by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 - b) US SPEC Acrylcoat by US Mix Products Co., Denver, CO; 800-397-9903, www.usmix.com.
 - c) Sealtight Acry-Lok by W. R. Meadows, Inc., Hampshire, IL; 800-342-5976, www.wrmeadows.com.
 - d) Or accepted equal.
 - b. Interior applications or exterior applications not subject to constant water immersions: Ethyl-vinyl acetate (EVA) copolymer liquid bonding agent and admixture; re-emulsifies once and will not re-wet; meets or exceeds ASTM C1059.
 - 1) Acceptable Products:
 - a) Tammsweld by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 - b) US SPEC Multicoat by US Mix Products Co., Denver, CO; 800-397-9903, www.usmix.com.
 - c) Or accepted equal.
 2. Structural Bonding Epoxy Adhesive: Two component, 100 percent solids, 100 percent reactive; meets or exceeds ASTM C881/C881M, Type V, Grade 2, Class B or Class C as appropriate.
 - a. Acceptable Products:
 - 1) MasterEmaco ADH 1090RS, MasterEmaco ADH 1420, or MasterEmaco ADH 327RS by Master Builders Solutions, Cleveland, OH; 800-228-3318 or 800-433-9517, www.master-builders-solutions.com.
 - 2) Dural 452 MV by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 - 3) Sealtight Rezi-Weld 1000 by W. R. Meadows, Inc., Hampshire, IL; 800-342-5976, www.wrmeadows.com.
 - 4) Or accepted equal.

- C. Repair Mortar: Exceeds ASTM C928, R1 and R2; rapid setting – minimum 1300 psi at three hours; 5500 psi at seven days per ASTM C109.
1. Acceptable Products:
 - a. MasterEmaco T 415/430 or MasterEmaco T 1060/1061 Repair Mortars by Master Builders Solutions, Cleveland, OH; 800-228-3318 or 800-433-9517, www.master-builders-solutions.com.
 - b. Euco-Speed, Versaspeed, or Speedcrete 2028 by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 - c. US SPEC Transpatch by US Mix Products Co., Denver, CO; 800-397-9903, www.usmix.com.
 - d. Or accepted equal.
- D. Repair Mortar (for patching over steel): Liquid polymer modified, containing and integral corrosion inhibitor, exceeds C928, R2; rapid setting – minimum 2500 psi at one day; 5000 psi at seven days per ASTM C109.
1. Acceptable Products:
 - a. MasterEmaco N 420CI with Acrylic Additive or MasterEmaco T 310CI by Master Builders Solutions, Cleveland, OH; 800-228-3318 or 800-433-9517, www.master-builders-solutions.com.
 - b. Concrete-Top Supreme by The Euclid Chemical Co., Cleveland, OH; 800-321-7628, www.euclidchemical.com.
 - c. US SPEC H2 by US Mix Product Co., Denver, CO; 800-397-9903, www.usmix.com.
 - d. Sikatop 122 Plus by Sika Corp., Lyndhurst, NJ; 800-933-7452, www.sikaUSA.com.
 - e. Or accepted equal.

2.08 ACCESSORIES

- A. Form Release Agent: Commercially formulated form release agents that will not bond with, stain or adversely affect concrete surface, and will not impair subsequent treatment of concrete surfaces, nor impede the wetting of surfaces to be cured with water or curing compounds. Product shall meet the VOC requirements at the location of use.
1. Product: Duogard as manufactured by W.R. Meadows or accepted equal.
- B. Capillary Barrier: Clean crushed rock; 3/4 inch nominal maximum size with no material passing a No. 4 sieve.
- C. Anchors, Anchor Bolts, Nuts, and Washers: Refer to Section 05 12 00.

2.09 CONCRETE MIX

- A. General:
1. Proportion concrete design mixes per ACI SPRC-301 Section 4.2.3 and ACI CODE-318 Section 26.4.3.
 2. Proportion concrete design mixes per ACI, prepared and tested by an independent testing laboratory acceptable to Architect and DSA prior to design mix approval. For each mix design, prepare and perform tests as follows:
 - a. Drying shrinkage test per modified ASTM C157/C157M as specified in this Section; provide at least three test specimens. Drying shrinkage test not required for below grade concrete or slab areas less than 100 square feet.

3. Proportioning without field experience or trial mixtures may be permitted with written approval from Architect and DSA, where concrete manufacturer can establish the uniformity of its production for concrete of similar type and strength based on recent test data in accordance with ACI CODE-318, Chapter 26, Article 26.4.4, "Documentation of Concrete Mixture Characteristics".
 4. Proportion concrete design mix to attain compressive strength as specified below and as needed, with early strength to meet Contractor's work program.
- B. Mix Designs: Refer to Drawings.
- C. Admixtures: Use specified admixtures as acceptable to Architect and DSA. Verify compatibility of concrete admixtures when using multiple admixtures.

2.10 CONCRETE MIXING

- A. Concrete shall be mixed per ACI PRC-304.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine and verify the following prior to concrete placement.
1. Forms are erected, adequately braced, sealed, lubricated (if required), and bulkhead provided where placing is to stop.
 2. Thoroughly water soak wood forms other than plywood at least twelve hours before concrete placement.
 3. Steel reinforcement are accurately positioned, securely tied and braced. Verify concrete cover requirements.
 4. Coordination with related work is completed.
 5. Anchors and embedded items are in position, securely held and braced.
 6. Construction joints and previously placed concrete are prepared as specified.
 7. Compliance with cold-weather or hot-weather requirements.
 8. Compliance with cleaning and preparation requirements.
- B. Report unacceptable conditions to Architect. Begin installation only when unacceptable conditions have been corrected.
- C. Concrete formwork, reinforcement, inserts, and embedded items are subject to Architect's acceptance. Notify Architect at least 48 hours prior to concrete placement.

3.02 PREPARATION

- A. Cleaning: Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris before placing concrete.

3.03 FORMWORK

- A. Design, construct, erect, brace, and maintain formwork according to ACI PRC-347.
- B. Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.04 STEEL REINFORCEMENT

- A. Fabricate to shapes, dimensions, and tolerances in accordance with accepted placement drawings conforming to CRSI Manual of Standard Practice, ACI MNL-66, ACI CODE-318, ACI SPEC-117, and CBC Chapter 19A.
- B. Standard Hooks and Bends: Conform to ACI 318/318R.
- C. Bending: Cold bend steel reinforcement in the field or at the mill. Heating for bending is not permitted unless otherwise specifically allowed by Architect and DSA.
- D. Reinforcement must not be straightened or re-bent without approval of Structural Engineer of Record (SEOR) and DSA.
- E. Weld steel reinforcement in accordance with AWS D1.4.
- F. Place steel reinforcement in accordance with accepted placement drawings in conformance with tolerances specified in ACI SPEC-117.
- G. Install steel reinforcement in largest practical lengths. Accurately position, support, and secure reinforcement against displacement. Locate support reinforcement with bar supports to maintain minimum concrete cover.
- H. Tie all splices and crossing points. Point wire tie ends away from the form.
- I. Offset laps in adjacent bars.

3.05 CONCRETE PLACEMENT

- A. Place concrete in accordance with ACI SPEC-301 and as specified in this Section.
 - 1. Concrete construction tolerances shall be per ACI SPEC-301 except the top surface of concrete supporting masonry construction shall have a maximum vertical deviation from elevation of +/- 1/2 inch.
- B. Before test sampling and placing concrete, water may be added at Project site when accepted by Architect, subject to limitations of ACI SPEC-301.
- C. Consolidation: Consolidate placed concrete with mechanical vibrating equipment per ACI SPEC-301.
 - 1. Concrete Floors and Slabs: Deposit and consolidate concrete for floors and slabs in a continuous operation within limits of construction joints until placement of a panel or section is complete.
 - 2. Consolidate concrete during placement so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Limit vibration duration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.
 4. Maintain reinforcement in position on chairs during concrete placement.
- D. Hot Weather Concreting: Place concrete according to ACI SPEC-305.1.
- E. Cold Weather Concreting: Place concrete according to ACI SPEC-306.1.

3.06 CONCRETE REPAIRS

- A. General: Comply with ACI SPEC-301, as follows:
1. Completed concrete work shall conform to applicable requirements of this Section and Contract Documents.
 2. Concrete work that fails to meet one or more requirements of the Contract Documents but subsequently is repaired to bring the concrete into compliance will be acceptable.
 3. Concrete work that fails to meet one or more requirements of the Contract Documents and cannot be brought into compliance with the Contract Documents is subject to rejection.
 4. Repair rejected concrete work by removing and replacing or by additional construction to strengthen or otherwise satisfy project requirements as directed by Architect. To bring rejected Work into compliance, use repair methods that meet applicable requirements for function, durability, dimensional tolerances, and appearance as determined by Architect.
 5. Submit proposed repair methods, materials, and modifications needed to repair concrete work to meet the requirements of the Contract Documents.
 6. Contractor shall be responsible to bring concrete work into compliance with requirements of Contract Documents.
- B. Defective Concrete: Repair and patch defective concrete work and concrete not conforming to required lines, details, and elevations. Use materials and methods specified in this Section as accepted by Architect. Serious defects, defects affecting structural strength, or unsatisfactory patching may be cause for complete removal and replacement of concrete.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycomb, rock pockets, and voids more than 1/2 inch in any direction in solid concrete. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with drypack grout before bonding agent has dried.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, repair mortar will match surrounding color. Patch a test area at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed, formed surfaces that affect concrete's durability and structural performance as determined by Architect and DSA.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness.
1. Repair defective finished surfaces including spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced section regardless of width, and other objectionable conditions.
 2. After concrete has cured fourteen days, correct high spots by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish areas to blend into adjacent concrete.
 4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surface in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete. Place, compact, and finish patching concrete to blend with adjacent finished concrete.
 5. Repair random cracks and single holes 1 inch or less in diameter with drypack grout. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place drypack grout before bonding agent has dried. Compact and finish patching material to match adjacent concrete.
- E. Moist cure patches and repairs for at least 72 hours.
- F. Perform concrete structural repairs subject to Architect's and DSA's acceptance.

3.07 FIELD QUALITY CONTROL

- A. General: Comply with requirements of Division 01.
- B. Testing Service: Owner will select and pay for independent testing agency.
- C. Strength Test Specimen Cylinders: Conduct sampling, curing, and testing per ASTM C172, ASTM C31/C31M, and ASTM C39/C39M. Contractor shall provide molds required for strength test cylinders. Test samples shall be taken at the point of concrete placement.
1. Frequency: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 50 cubic yards of concrete, nor less than once for each 2000 square feet of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.
 2. A strength test shall be the average of the strengths of at least two 6 inch by 12 inch cylinders or at least three 4 inch by 8 inch cylinders made from the same sample of concrete and tested at the test age designated for the determination of concrete compressive strength.
 3. Cylinder Label and Records: Mark and date each test cylinder. Maintain records of test specimen cylinders and send copies to Architect, Structural Engineer, DSA, Project Inspector, and Owner. Record the following information:
 - a. Cylinder identification mark.
 - b. Date made.

- c. Concrete supplier.
 - d. Slump.
 - e. Specified concrete design strength.
 - f. Pour location and type of structural member.
 - g. Compressive strength test date and age.
 - h. Admixtures added to concrete mix.
 - i. Air content.
4. Compressive Strength Tests: Test laboratory cured specimens at the following ages and report compressive strengths as follows:
 - a. 7 days at the start of use of each class of concrete or change in mix or aggregates.
 - b. 7 days where early compressive strength is required.
 - c. 28 days.
 - d. Hold specimens for one strength test in reserve.
 5. Test Reports: Furnish two copies of test reports directly from testing agency to Contractor, Architect, Structural Engineer, DSA, Project Inspector, and Owner.
- D. Slump Test: ASTM C143/C143M. Conduct slump testing when test cylinders are made and additionally for every 150 cubic yards of concrete. Perform additional tests when concrete consistency appears to change. Slump not meeting slump in accepted mix design (\pm one inch) will be rejected. Contractor shall provide slump cones.
- E. Air Content Tests: ASTM C231/C231M for normal weight concrete. Conduct air content tests from the first two batches of concrete mixed each day and when test cylinders are made. Concrete not meeting air entrainment requirements shall be rejected and removed.
- F. Density: ASTM C138/C138M. Conduct density testing when test cylinders are made.
- G. Concrete temperature: ASTM C1064/C1064M. Check concrete temperature when test cylinders are made and every hour when ambient temperature in below 40 degrees F or above 90 degrees F.
- H. In the event the cylinders tested do not meet the required concrete design strength, conduct core tests and additional tests or inspections as may be required by Architect to ascertain strength of placed concrete. Costs for additional tests and inspections shall be borne by Contractor.

END OF SECTION

Concrete Mixture Design Submittal Checklist

- Specify Use: All mix designs must clearly note the concrete type or use. (i.e. footings, slab on grade, site concrete)
- Mix Design: Provide concrete mixture designs with proportions and characteristics including all admixtures.
- Gradation: Provide combined aggregate gradation by weight for all course and fine aggregates.
- Weight: Provide dry unit weight of mix. Normal weight concrete shall be limited to 145 PCF.
- Material Certificates: Provide supplier's certification that materials conform to specifications. This includes aggregates, admixtures, and cementitious materials such as cement, fly ash, silica fume, slag cement, and metakaolin.
- Product Data: Provide product literature for each product and admixture used. Include manufacturer's specification, written instructions, and installation procedures.
- Required SCM: Mix design must contain the percentage or supplementary cementitious materials noted in mix design table of the specifications.
- Admixtures: Where multiple admixtures are used, provide a letter from all manufacturers indicating there are no compatibility problems or adverse effects resulting from combination of products.
- Shrinkage: Provide shrinkage test per modified ASTM C157/C157M at 21 days. Shrinkage test must be for the same mix specified or a similar mix with the same water cement ratio and aggregate source. (Exception: shrinkage testing is not required for below grade concrete)
- Testing / Proportion Method: Concrete must be proportioned per the requirements of ACI Spec-318-20. Indicated method used and provide complete test data and documentation for the chosen proportion method.

SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete masonry units (CMU).
- B. Reinforcement.
- C. Accessory items.

1.02 RELATED SECTIONS

- A. Section 09 91 00 – Painting.

1.03 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:

- 1. ACI 315 – Details and Detailing of Concrete Reinforcement.
- 2. ASTM A951/A951M – Standard Specification for Steel Wire for Masonry Joint Reinforcement.
- 3. ASTM C5 – Standard Specification for Quicklime for Structural Purposes.
- 4. ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units.
- 5. ASTM C94/C94M – Standard Specification for Ready Mixed Concrete.
- 6. ASTM C140 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
- 7. ASTM C144 – Standard Specification for Aggregate for Masonry Mortar.
- 8. ASTM C207 – Standard Specification for Hydrated Lime for Masonry Purposes.
- 9. ASTM C270 – Standard Specification for Mortar for Unit Masonry.
- 10. ASTM C404 – Standard Specification for Aggregates for Masonry Grout.
- 11. ASTM C476 – Standard Specification for Grout for Masonry.
- 12. ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- 13. ASTM C1019 – Standard Test Method for Sampling and Testing Grout.
- 14. ASTM D1056 – Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber.
- 15. TMS 402 – Building Code Requirements for Masonry Structures.
- 16. TMS 602 – Specification for Masonry Structures.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01.

- B. Shop Drawings indicating bar sizes, spacings and locations of reinforcing steel, including reinforcing steel at door, window, and utility openings, bending and cutting schedules, supporting and spacing devices, and location/layout and details of each joint type.
- C. Product Data: Submit product data for each product specified in this Section with the product and selected attributes clearly identified.
- D. Certified Mix Design for block, grout, and mortar: Include results of testing or test data when used to establish mix proportions for grout.
- E. Certificate of conformance stating that masonry units meet or exceed applicable ASTM specifications referenced in this Section.
- F. Two full size samples of each type of masonry unit specified, in selected colors.

1.05 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: The masonry work shall comply with the requirements of this Section and, in addition, shall conform to the applicable requirements of TMS 402 and TMS 602, 2022 California Building Code (CBC), Chapter 17A "Special Inspections and Tests", Chapter 19A "Concrete", and Chapter 21A "Masonry".
 - 1. Inspection:
 - a. Masonry Construction: Per Section 1705A "Required Special Inspections and Tests", Article 1705A.4 "Masonry Construction".
 - b. Reinforcing Bar Welding: Per Section 1705A, Table 1705A.3 "Required Special Inspections and Tests of Concrete Construction" [and Table 1705A.2.1 "Required Special Inspections and Tests of Steel Construction", Item 5b].
 - 2. Field Tests:
 - a. Mortar and Grout Tests: Per Section 2105A.3 "Mortar and Grout Tests".
 - b. Masonry Core Testing: Per Section 2105A.4 "Masonry Core Testing".
- B. Single Source Responsibility for Masonry Units: Obtain masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- C. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality including color[s] for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate. One cement type shall be used for all mortar throughout the project.
- D. Pre-Installation Meetings:
 - 1. Conduct pre-installation meeting in accordance with provisions of Division 01.
 - 2. Convene pre-installation meeting prior to commencing work of this Section.
 - 3. Take minutes of meeting. Distribute to all attendees and concerned parties within five days.

1.06 DEFINITIONS

- A. Grout Lift: The increment of height to which grout is placed into masonry in one continuous operation within a total grout pour.

- B. Grout Pour: The total height of masonry to be grouted prior to the erection of additional masonry. A grout pour consists of one or more grout lifts.
- C. High-Lift Grouting: Grout pour full height of construction between horizontal cold joints using multiple grout lifts.
- D. Low-Lift Grouting: Units laid and grouted to a maximum height of four feet-zero inches prior to the erection of additional masonry.

1.07 TESTS AND INSPECTIONS

- A. Tests requested by Architect shall be made by a testing laboratory selected and paid for by Owner. Any masonry work failing to meet required design stresses as specified hereinafter shall be dismantled and replaced at no cost to Owner.
 - 1. Tests requested by Contractor to establish design stresses when tests made by the Testing Laboratory indicate defective masonry shall be paid for by Contractor.
- B. Inspection: Approval of the reinforcing steel after installation must be received from Architect and Special Inspector. Architect and Special Inspector shall be notified at least 48 hours in advance of the beginning of grouting operations.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Unload masonry units carefully and store on raised platform. Masonry units shall be maintained under waterproof cover protected from weather.
- C. Protect cementitious materials against exposure to moisture. Store cementitious materials off the ground, under cover, and in a dry location. Use of cementitious or other materials that have become caked and hardened from absorption of moisture will not be permitted.
- D. Store and protect aggregates where grading and other required characteristics can be maintained.
- E. Store and protect masonry accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.09 JOB AND ENVIRONMENTAL CONDITIONS

- A. Environmental:
 - 1. Cold Weather Conditions: Do not place unit masonry when temperature is below 40 degrees F unless Architect accepts and Contractor provides means for preventing damage from freezing before and after placement.
 - 2. Hot Weather Conditions: Protect masonry construction from direct exposure to wind and sun when erected; with an ambient air temperature of 99 degrees F in the shade with relative humidity less than fifty percent.
- B. Do not apply uniform structural loads on CMU construction for at least 12 hours after constructing masonry walls or columns.

- C. Do not apply concentrated structural loads on CMU construction for at least 3 days after constructing masonry walls or columns and grout has reached compressive design strength.
- D. Protect all construction from droppings of mortar.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers, Concrete Masonry Units (CMU):

1. Basalite Block Company, Inc., Dixon, CA; 800-776-6690, 707-678-1901, www.basalite.com.
2. Calstone Company, Sunnyvale, CA; 408-984-8800, www.calstone.com.
3. Angelus Block Co., Inc., Sun Valley, CA; 818-767-8576, www.angelusblock.com.

B. Substitutions: Under provisions of Division 01.

2.02 CONCRETE MASONRY UNITS

A. Hollow Load Bearing Units: ASTM C90, maximum oven dry density of 135 pounds per cubic foot, 2000 pounds per square inch minimum compressive strength. Provide open and closed-end units, bond beams, U beams, half units and any additional special shapes and sizes as required to complete the Work. Units shall be of the following types:

1. Precision smooth finish, sizes as indicated on Drawings; color as selected by Architect.

2.03 MORTAR AND GROUT

A. Portland Cement: ASTM C150, Type I, except use Type III for construction below 40 degrees F. Provide natural color or white cement as required to produce required mortar color. Masonry cement will not be permitted.

B. Aggregate:

1. For Mortar: ASTM C144.
2. For Grout: ASTM C404.

C. Hydrated Lime: Type S, ASTM C207.

D. Quick Lime: ASTM C5.

E. Water: Clean and potable, free from impurities detrimental to mortar and grout.

F. Admixtures:

1. Unless otherwise specified, use admixtures only with Architect's and DSA's acceptance and without adversely affecting bond or compressive strength.
2. Grout Additive: Grout pours greater than four feet-zero inches shall contain "Grout Aid" by Sika Chemical Corporation or "Pre-Mix Products Grout Additive" by Valley Abrasive Shot, Inc.
 - a. Mix grout additive as recommended by manufacturer.

G. Color of mortar as selected by Architect.

2.04 REINFORCEMENT, ACCESSORIES, AND RELATED ITEMS

- A. Steel reinforcement including anchors, ties and accessories: shall conform to CBC Section 2103A.4 "Metal Reinforcement and Accessories."
- B. Reinforcing Steel: Same type and quality specified for concrete reinforcing, Section 03 20 00.
- C. Wire Ties: No. 16 annealed wire for tying reinforcing steel.
- D. Wire Joint Reinforcement: See Drawings for specified type of joint reinforcing.
 - 1. Ladder Reinforcing: 220 Ladder-Mesh joint reinforcement as manufactured by Hohmann & Barnard, Inc. or accepted equal, with the following characteristics:
 - a. Joint reinforcement shall conform to ASTM A951/A951M.
 - b. Wire Size: 9 gauge side rods x 9 gauge cross rods, cross welded at 16 inches on center.
 - c. First cross rods shall be welded 12 inches from each end to allow lap splices.
 - d. Ladder shall be hot-dip galvanized after fabrication in conformance with ASTM A153/ASTM A153M. Coating shall be applied at a rate of 1.5 ounces per square foot.
 - 2. Wire Reinforcing: Continuous Wire Reinforcement by Hohmann & Barnard, Inc. or accepted equal, with the following characteristics:
 - a. Joint reinforcement shall conform to ASTM A951/A951M.
 - b. Wire Size: Continuous 9 gauge cold-drawn steel wire.
 - c. Layout lap splices as indicated on Drawings.
 - d. Ladder shall be hot-dip galvanized after fabrication in conformance with ASTM A153/ASTM A153M. Coating shall be applied at a rate of 1.5 ounces per square foot.
- E. Bonding Agent: MasterEmaco ADH 326 two-component 100 percent solids liquid epoxy bonding adhesive in compliance with ASTM C881, Type II, Grade 2, Class C as manufactured by Master Builders Solutions/BASF, or accepted equal.
- F. Control Joints: Closed cell neoprene rubber conforming to ASTM D1056, Grade 2A1. 3/8 inch thick by 6 inches wide. Product: NS Closed Cell Neoprene Sponge as manufactured by Hohmann & Barnard Company, Hauppauge, NY; 800.645.0616, www.h-b.com, or accepted equal.

2.05 MIXES AND MIXING

- A. Mortar:
 - 1. Meet the requirements of CBC Section 2103A.2 and ASTM C270 Type S. Mix designs shall meet one of the following criteria:
 - a. Conform to the type and proportions of ingredients in compliance with the Proportion Specification of ASTM C270.
 - b. Conform to mix design and mortar tests performed in accordance with the Property Specification of ASTM C270.
 - 2. Mortar shall be mixed as follows, with a total mixing time not less than ten minutes.
 - a. Place approximately half of required water and sand into mixer while running.
 - b. Add cement and remainder of sand and water into mixer in that order and mix for a period of at least two minutes.
 - c. Add lime and continue mixing as long as needed to secure a uniform mass.

3. Use and place mortar in final position within 2-1/2 hours after mixing. Mortars that have stiffened due to evaporation of water may be re-tempered with water as necessary to restore required consistency during that time period.

B. Grout:

1. Grout shall conform to the requirements of TMS 602 and shall be a coarse grout designed to attain a compressive strength of not less than 2,000 psi at 28 days.
2. Proportions: Grout shall be proportioned as specified by one of the following methods:
 - a. Based on proportions specified in ASTM C476.
 - b. Based on laboratory or field experience with the grout ingredients and the masonry units to be used.
 - 1) For coarse grout, the coarse and fine aggregates shall be combined such that the fine aggregate part is not greater than 80 percent of the total aggregate weight (mass). Coarse grout proportioned by weight shall contain not less than 564 pounds of cementitious material per cubic yard.
 - 2) If this method is selected, Contractor shall submit documented history of grout mix design and results of test data used to establish mix proportions from no less than ten different recent projects.
 - 3) Compressive strength shall be determined in accordance with ASTM C1019.
3. Aggregate for grout shall conform to the requirements set forth in ASTM C404, Aggregates for Grout. Coarse grout shall be used in grout spaces 2 inches or more in width and in all filled-cell masonry construction.
4. Materials for grout shall be measured in suitable calibrated devices. After the addition of water, all materials shall be mixed for at least three minutes in a drum type batch mixer. Mixing equipment and procedures shall produce grout with the uniformity required for concrete by ASTM C94.
5. Grout consistency at time of placement shall enable full grouting of all spaces scheduled to receive grout.

2.06 SOURCE QUALITY CONTROL

A. Where required by governing code, Owner's Testing Agency will:

1. Select masonry units by random sampling at the plant and test units for strength, absorption, and moisture content in accordance with ASTM C140; report strengths based on net area.
2. Review mix designs for mortar and grout.
3. Review certificates of compliance for materials. Sample and test where non-conformance is suspected.
4. Perform masonry and grout tests.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive masonry and verify following:

1. That foundation surface is level to permit bed joint with range of 1/4 inch to 1-1/4 inch.
2. That edge is true to line to permit protection of masonry to less than 1/4 inch.

3. That projecting dowels are free from loose scale, dirt, concrete, or other bond-inhibiting substances and properly located.
- B. Do not begin work before unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean concrete surfaces to receive masonry. Remove laitance or other foreign material lodged in surfaces by sandblasting or other means as required.
- B. Ensure masonry units are clean and free from dust, dirt or other foreign materials before laying the units.
- C. Establish lines, levels and coursing. Protect from disturbances.
- D. Provide temporary bracing during erection of masonry work. Maintain in place until masonry has set to provide permanent bracing.

3.03 COURSING

- A. Install unit masonry work in accordance with CBC Chapter 21A.
- B. Place unit masonry to lines and levels indicated to the following tolerances, as well as tolerances indicated in TMS 602:
 1. Variation from unit to adjacent unit: 1/8 inch maximum.
 2. Variation from plane to wall: $\pm 1/4$ inch in 10 feet; $\pm 3/8$ inch in 20 feet; $\pm 1/2$ inch maximum.
 3. Variation from plumb: $\pm 1/4$ inch in 10 feet; $\pm 3/8$ inch in 20 feet; $\pm 1/2$ inch maximum.
 4. Variation of level coursing: 1/4 inch in 10 feet; 1/2 inch maximum.
 5. Variation of joint thickness: $\pm 1/8$ inch.
- C. Bond: Use running bond typical unless otherwise noted. Lay concrete masonry units with vertical joints located at center of unit in course below.
- D. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
- E. Preserve the vertical continuity of cells in concrete unit masonry. The minimum clear horizontal dimensions of vertical cores shall be 3 inches by 3 inches for an 8-inch wide block.

3.04 PLACING AND BONDING

- A. Do not install concrete masonry units which are wet, cracked, broken or chipped beyond ASTM C90 finish and appearance tolerances.
- B. Lay only dry concrete masonry units.
- C. Perform jobsite cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.
- D. Lay units with bed and head joints filled from the faces of the units to a distance in not less than the thickness of the face shell.

1. Webs shall be fully mortared in all courses of piers, columns, and pilasters, and when necessary to confine grout or insulation.
 2. Vertical cells to be grouted shall be aligned and have unobstructed openings for grout.
 3. Buttering of joint corners and deep or excessive furrowing of mortar joints is not permitted.
- E. Keep cavity airspace clean of mortar. Clean out promptly if mortar falls into cavity airspace.
- F. In-Progress Cleaning:
1. Remove excess mortar.
 2. Dry brush exposed masonry prior to the end of each workday.
 3. Protect wall from mud splatter and mortar droppings.
 - a. Set scaffolds and scaffold boards so that mortar is not deflected onto masonry.
 - b. At the end of each workday, turn scaffold boards so that rainwater is not deflected onto masonry.
 4. Place concrete masonry units such that mortar does not run down the face of the wall or smear the masonry face.
- G. Adjustments:
1. Do not shift or tap concrete masonry units after mortar has taken initial set.
 2. If adjustment is required, remove unit and mortar in its entirety and replace.
- H. After joints are tooled, cut off mortar tailings with trowel and dry brush excess mortar burrs and dust from the face of the masonry.
- I. Fully bond interior and exterior corners and properly anchor intersecting walls.

3.05 JOINTS

- A. Horizontal and vertical joints at masonry units shall be as specified herein and concrete unit masonry joints shall be 3/8-inch wide and as follows:
1. Point joint tight in masonry below ground.
 2. All end joints shall be fully filled with mortar and joints squeezed tight. Slushing of mortar into joints shall not be permitted. Mortar in bed joints shall be held back approximately 1/2 inch from cell to provide positive bond with grout.
 3. Exposed Joints:
 - a. At all interior and exterior exposed surfaces of concrete masonry units, vertical and horizontal joints shall be concave, unless noted otherwise.
 4. Tool vertical joints first.
 5. Concave joints shall be formed by striking the mortar flush, and after partial set tooled with a tool of sufficient length to provide a uniform joint, free of waves. Tool shall be of a diameter to provide a joint that is as close to flush as possible. Use tool with large enough radius that joint is not raked free of mortar.

3.06 MASONRY REINFORCEMENT

- A. Place reinforcement in accordance with ACI 315, to the tolerance specified in Drawings.

- B. Reinforcing steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of bars for bending will not be permitted.
1. Bars shall conform accurately to the sizes, shapes, lines and dimensions shown on Drawings and with hooks and bends made as detailed. Bars shall be placed as indicated on Drawings and centered on grout space.
 2. At the time grout is placed around it, reinforcing steel shall be clean of mill scale or other coatings that will destroy or reduce bond.
 3. All vertical reinforcing steel shall be installed in one piece, full height of wall, and braced throughout its height in a manner that will retain the steel in proper position and provide the proper clearance.

3.07 GROUTING

A. General Requirements:

1. All cells shall be grouted solid.
2. Use grout pump, hopper or bucket to place grout.
3. Place grout in final position within 1-1/2 hours after introduction of mixing water.
 - a. Place grout and rod with a 3/4-inch flexible cable vibrator sufficiently to cause it to flow into all voids between the cells and around the reinforcing steel. Slushing with mortar will not be permitted.
 - b. Do not insert vibrators into lower pours that are in a semi-solidified state.
4. Stop grout approximately 1-1/2 inches below top of last course; except at top course bring grout to top of wall. Where bond beams occur, stop grout pour a minimum of 1/2 inch below the top of the masonry.
5. Prior to grouting, the grout space shall be cleaned so that all spaces to be filled with grout do not contain mortar projections greater than 1/2 inch, mortar droppings or other foreign material.
6. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.
7. Cleanouts are required when high-lift grouting method is used. Cleanouts shall be provided in the bottom course at every vertical rebar. Cleanouts shall be located on concealed faces of wall and shall be sealed after inspection and before grouting. Cleanouts will not be allowed on exposed faces of wall.

B. High-Lift Grouting:

1. For bidding purposes, high-lift grouting shall not be anticipated. High-lift grouting may be considered at select locations only when specifically reviewed and accepted by Architect.
2. Where high lift grouting is used, the method shall conform to DSA IR 21-2.13.
3. Maximum grout pour height, comprised of multiple four feet-zero inch maximum grout lifts:
 - a. 12 feet-0 inches for 8 inch wide CMU.
4. Cleanouts are required when high-lift grouting method is used. Cleanouts shall be provided in the bottom course at every vertical rebar. Cleanouts shall be located on concealed faces of wall and shall be sealed after inspection and before grouting. Cleanouts will not be allowed on exposed faces of wall.

C. Low-Lift Grouting:

1. Units shall be laid to a maximum height of four feet-zero inches before grouting, and all over-hanging mortar and mortar droppings shall be removed.
2. Grouting shall follow each four feet-zero inches height of construction laid, and shall be consolidated so as to completely fill all voids and embed all reinforcing steel.

3.08 CONTROL JOINTS

- A. Install control joints in continuous lengths as shown on Drawings.
- B. Size joints in accordance with manufacturer's recommendations for sealant performance.
- C. Install backer rod and sealant under provisions of Section 07 92 00.
- D. Install preformed control joint filler at locations indicated on drawings.
- E. Use proper size material to create sealant joint specs.

3.09 BOND BEAMS

- A. Bond beams shall be located where shown and detailed on Drawings, and shall be reinforced as indicated and as hereinafter specified.

3.10 BUILT-IN WORK

- A. Miscellaneous Embedded Items: All items indicated to be embedded in masonry shall be carefully located and anchored to prevent movement during grouting operations. Avoid cutting and patching.
 1. Install all anchor bolts and anchors furnished under other Sections.
- B. Pipes and Conduits: Horizontal and vertical pipes and conduits embedded in walls shall not exceed the limitations indicated on the Structural Drawings.

3.11 CUTTING AND FITTING

- A. Cutting: Make all unit cuts, including those for bonding, holes, boxes, etc., with motor-driven masonry saws, using either an abrasive or diamond blade. Cut neatly and locate for best appearance. Cut with proper tools to provide straight, unchipped edges and take care to prevent raking masonry unit corners or edges.
- B. Cut and fit for miscellaneous penetrations. Cooperate with other Sections' work to provide correct size, shape, and location.
- C. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

3.12 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units.
- B. Pointing: During the tooling of joints, enlarge any voids or holes and completely fill with mortar.

- C. Dry brush masonry surface after mortar has set, at end of each day's work and after final pointing.
- D. Leave work and surrounding surface clean and free of mortar spots and droppings.
- E. Cleaning:
 - 1. Keep walls clean daily during installation using brushes, rags, and burlap squares. Do not allow excess mortar lumps or smears to harden on the finished surfaces. Remove green mortar with burlap or a dry cloth.
 - 2. Upon completion of masonry installation, repair all holes. Mortar joints that are not properly tooled or that show cracks shall be cut out, removed, and repointed at no cost to the Owner.
- F. Final Cleaning:
 - 1. Just prior to project substantial completion, and prior to the application of paint finish, clean masonry surfaces.
 - a. Cleaning Product: PROSOCO Sure Klean line of cleaners, product appropriate to installed concrete units, or accepted equal.
 - 1) Run-off from cleaning operations shall be contained, neutralized, and disposed of per State and local regulations. Obtain necessary permits for disposal of run-off.
 - b. Sandblasting is an acceptable alternative means of cleaning, provided that no silica particulates are used.
 - 1) Sandblasting operations shall not generate large quantities of dust. Employ wet sandblasting methods to control dust.
 - 2. Final cleaning and paint application shall not be scheduled until walls have thoroughly dried out and sealants have been installed and cured.

3.13 FIELD QUALITY CONTROL

- A. Owner's Inspector and/or Testing Agency will:
 - 1. Provide the following checks as a minimum:
 - a. Measurement and mixing of field mixed mortar and grout.
 - b. Moisture conditions of masonry units at time of laying.
 - c. Inspection of laying of units with special attention to joints and bonding of units at corners.
 - d. Proper placement of reinforcement including splices, clearances and supports.
 - e. Observation of placement of pipes, conduits, or other weakening elements.
 - f. Inspection of grout spaces immediately prior to grouting for removal of mortar fins, dirt and debris.
 - g. Continuous inspection of grout placement with attention to procedures to avoid segregation and achieve proper consolidation.
 - h. Perform or supervise sampling for testing.
- B. Contractor shall be responsible for repair of any damage to work caused by testing.
- C. Contractor shall pay Owner's Testing Agency for all additional testing required, including masonry cores, when laboratory tests of specimens show compressive strengths below specified minimum and judged to be inadequate by Architect.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing and support members.
- B. Base plates and bearing plates.
- C. Grouting under base plates.

1.02 RELATED SECTIONS

- A. Section 09 91 00 – Painting: Paint finish.

1.03 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. AISC 303-16 – Code of Standard Practice for Steel Buildings and Bridges.
 - 2. ANSI B18.22.1 – Plain Washers.
 - 3. ANSI B18.23.1 – Beveled Washers.
 - 4. ASTM A6/A6M – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - 5. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
 - 6. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 7. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - 8. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 9. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - 10. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 11. ASTM A572/A572M – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
 - 12. ASTM A780/A780M – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 13. ASTM A992 – Standard Specification for Structural Steel Shapes.

- 14. ASTM F844 – Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
- 15. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- 16. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- 17. AWS D1.1 – Structural Welding Code – Steel.
- 18. AWS D1.4 – Structural Welding Code – Reinforcing Steel.
- 19. AWS D1.8 – Structural Welding Code – Seismic Supplement.
- 20. AWS D2.0 – Specifications for Welded Highway and Railway Bridges.
- 21. RCSC – Specification for Structural Joints Using High Strength Bolts.
- 22. SSPC – Steel Structures Painting Manual, Volumes 1 and 2.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings:
 - 1. Pages of electronic submittals shall be labeled and bookmarked. Bookmark naming shall match the naming of corresponding shop drawing sheets.
 - 2. Indicate profiles, sizes, spacing, and locations of structural members, attachments, fasteners, and required connections, including connections not detailed on Drawings.
 - 3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
 - 4. Clearly distinguish between shop and field bolts and welds.
- C. Manufacturer's Mill Certificate: Submit Manufacturer's Certificates under provisions of Division 01, certifying that steel, fasteners and welding electrodes meet or exceed specified requirements.
- D. Mill Test Reports: Submit Manufacturer's Reports under provisions of Division 01, indicating structural strength, destructive and non-destructive test analysis and ladle analysis.
- E. Submit product data for type of metal primer proposed for use.
- F. Welders' Certificates: Submit certificates under provisions of Division 01, certifying welders employed on the Work, verifying AWS qualifications within the previous twelve months.
 - 1. Welders who have not performed welding for period of three or more months shall be requalified.
 - 2. Welders whose work fails to pass inspection shall be requalified before performing further welding.
 - 3. Contractor shall pay costs of certifying qualifications.
- G. Welding Procedures: Submit proposed Welding Procedure Specifications (WPS). Where WPS is not prequalified by AWS D1.1, submit supporting Performance Qualification Records (PQR).
- H. Qualification Data: For qualified Fabricator and Installer.

1.05 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, Code of Standard Practice for Steel Buildings and Bridges.
- B. Seismic-Force-Resisting System: Elements of structural-steel frame designated as "SFRS" or along grid lines designated as "SFRS" on Drawings, including columns, beams, and braces and their connection.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches.
 - 2. Welded built-up members with plates thicker than 2 inches.
 - 3. Column base plates thicker than 2 inches.

1.06 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with the AISC Specification for Structural Steel Buildings, Code of Standard Practice for Steel Buildings and Bridges and Quality Criteria and Inspection Standards.
- B. Fabricator Qualifications: Company specializing in performing the work of this Section with sufficient documented experience.
- C. Installer (Erector) Qualifications: Company specializing in performing the work of this Section.

1.07 REGULATORY REQUIREMENTS

- A. Conform to 2022 California Building Code (CBC), Chapter 16A "Structural Design", Chapter 22A "Steel", and Chapter 17A "Special Inspections and Tests".
- B. Structural Tests and Inspections: Refer to DSA Structural Tests and Inspection Sheet (DSA Form DSA-103).
- C. Materials:
 - 1. Material identification per CBC Chapter 22A, Section 2202A.1.
 - 2. Protection of structural steel per CBC Chapter 22A, Section 2203A.1.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on shop drawings.
- B. Coordinate fabrication and delivery of structural steel items with concrete work and with all other trades to permit such items to be built into the structure without delay.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials to be Installed Under Other Sections: Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete construction shall be delivered to the project site in time to be installed before start of cast-in-place concrete operations.

B. Storage of Materials:

1. Structural steel members to be stored at the Project site shall be placed above ground, on platforms, skids or other supports.
2. Steel shall be protected from corrosion.
3. Other materials shall be stored in a watertight, dry place until ready for installation in the Work.
4. Packaged materials shall be stored in their original package or container.
5. Do not store materials on the structure in a manner that might cause distortion or damage to members of supporting structures. Repair or replace damaged materials or structure as directed by Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel Members:

1. ASTM A992 Grade 50 for wide flange and WT shapes.
2. ASTM A36/A36M or A572 Grade 50 for plates, as noted on Drawings.
3. ASTM A36/A36M for channels, angles and all other shapes.

B. HSS:

1. Tubing: ASTM A500, Grade C.
2. Round: ASTM A500, Grade C.

C. Pipe: ASTM A53/A53M, Type E or S, Grade B.

D. Bolts and Nuts: ASTM A307, Grade A, with ASTM A563, Grade A, hex nuts; ASTM F3125, Grade A325N, Type 1, with ASTM A563, Grade C, heavy hex nuts; anchor bolts, ASTM F1554, grade as indicated on Drawings.

E. Welding Materials:

1. Typical Weld Locations: AWS D1.1; type required for materials being welded.
2. SFRS and Demand Critical Welds: AWS D1.8; filler metal shall be classified as low hydrogen and shall have a minimum Charpy V-notch toughness of twenty foot-pounds at -30 degrees F for SFRS welds and forty foot-pounds at 40 degrees F for Demand Critical Welds as determined by AWS classification or manufacturer certification. Demand critical weld material shall also meet heat input testing requirements of AWS D1.8, Clause 6.3.

F. Circular washers for common bolts: ASTM F844, Type A, and ANSI B18.22.1.

G. Beveled washers for common bolts: ANSI B18.23.1.

H. Post-Installed Concrete Anchors: ICC approved, as indicated and manufactured by Hilti or accepted equal.

I. Welded Headed Stud Anchors: ASTM A108. Welding, testing and inspection shall be in accordance with AWS D1.1.

- J. Steel Shop and Touch-Up Primer: TNEMEC Series 115 Uni-Bond DF or accepted equal.
- K. Shop and Touch-Up Zinc Rich Primer for Galvanized Surfaces: ZRC Galviline Galvanizing Repair Compound as manufactured by ZRC Worldwide Company, Phone: (800) 831-3275, or accepted equal.
- L. Weld filler material: All weld filler material shall have a minimum tensile strength of 70 KSI per AWS D1.1, latest edition approved by code enforcement agency.
- M. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.

2.02 FABRICATION

- A. General: Fabricate items of structural steel in accordance with AISC specifications and as indicated on Drawings. Properly mark and match-mark all materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling.
 - 1. Welded splicing of structural members may be done only upon written acceptance by Architect, unless otherwise indicated on Drawings. Splicing shall be thoroughly examined by a nondestructive means at Contractor's expense. Inspection shall be made by a recognized and approved testing laboratory; procedure, technique and standards of acceptance shall conform to Appendix E of AWS Standard D2.0-69. Correct faulty welds and re-examine in a manner specified for original welds.
- B. Welded Construction:
 - 1. Weld in accordance with AISC using manual shielded arc method or flux cored arc method in accordance with AWS D1.1 and AWS D1.8. Groove welds shall be complete joint penetration welds, unless specifically designated otherwise on Drawings.
 - 2. Remove back-up plates for complete joint penetration welds when specifically requested by testing laboratory to perform non-destructive testing. Remove at no cost to Owner.
 - 3. Weld reinforcing steel in accordance with AWS D1.4 and using prequalified procedures.
- C. Connections:
 - 1. Weld or bolt shop connections as indicated.
 - 2. Bolt field connections except where welded or other connections are indicated. Provide unfinished threaded fasteners only where noted on Drawings and for temporary bracing to facilitate erections.
- D. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for the passage of work through steel framing members as indicated. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work. Cut, drill or punch holes perpendicular to metal surfaces. Thermally cut holes are only permitted at anchor rod holes.

2.03 FINISHES

- A. Prepare structural component surfaces in accordance with SSPC SP-2 at concealed locations and SSPC SP-6 at exposed locations.
- B. Do not prime surfaces in direct contact with concrete, where field welding is required, or contact surfaces of steel-to-steel connections.
- C. All un-exposed, concealed, or enclosed exterior steel requires no finish.
- D. All exposed exterior steel shall be galvanized unless otherwise noted.
 - 1. Galvanize in accordance with ASTM A123/A123M, designated steel items. Provide minimum 1.25 ounce per square foot galvanized coating.
 - 2. At galvanized members, touch-up all welds with zinc-rich primer.
- E. Column Bases: Column bases and base plates shall be finished in accordance with the following requirements:
 - 1. Steel bearing plates 2 inches or less in thickness are permitted without milling provided a smooth and notch-free contact bearing surface is obtained. Steel bearing plates over 2 inches but not over 4 inches in thickness are permitted to be straightened by pressing or, if presses are not available, by milling for bearing surfaces, except as stipulated in subparagraphs (2) and (3) below, to obtain a smooth and notch-free contact bearing surface. Steel bearing plates over 4 inches in thickness shall be milled for bearing surfaces, except as stipulated in subparagraphs (2) and (3) below.
 - 2. Bottom surfaces of bearing plates and column bases that are grouted to ensure full bearing contact on foundations need not be milled.
 - 3. Top surfaces of bearing plates need not be milled when complete-joint-penetration groove welds are provided between the column and the bearing plate.

2.04 TESTING AND INSPECTION

- A. General: Owner will engage and pay a testing agency to perform the following services:
 - 1. Review manufacturer's certificates and check heat numbers and that the steel is properly identified in accordance with CBC Section 2202A "Identification of Steel for Structural Purposes".
 - 2. Testing of unidentified materials or as directed by Owner.
 - 3. Provide inspection per CBC Sections 1705A.2 and 1705A.13.
 - 4. Provide testing per CBC Section 1705A.14.
 - 5. In the event an examination discloses faulty welds and additional tests are required to fully examine the welds, the cost of the additional tests shall be paid for by Owner and back-charged to Contractor.
 - 6. All defective welds shall be repaired and tested at no expense to Owner.
 - 7. Perform any physical tests of structural steel as required by Architect. Perform ultrasonic tests on members as determined by Architect to determine if delamination defects in steel members are evident.

8. High-strength bolting testing and inspection shall conform to the following requirements:
 - a. Perform pre-installation verification of pretensioned bolts per RCSC Section 7.1 for the selected pretensioning method.
 - b. Inspect bolted joints per RCSC Section 9 and CBC Sections 1705A.2.1 and 2213A.
 - c. All fasteners failing to meet the specified tension shall be examined to determine the cause of failure and re-tested.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Beginning of installation means erector accepts existing conditions.
- C. Bolts shall be clean and free of grease, oil and all other deleterious substances.

3.02 ERECTION

- A. Allow for erection loads and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection and installation of permanent bracing.
- B. Field weld components indicated on shop drawings.
- C. Do not field cut or alter structural members without acceptance of Architect and DSA.
- D. After erection, prime welds, abrasions and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Setting Base Plates:
 1. Clean concrete bearing surfaces and roughen to improve bond. Clean the bottom surface of base plates.
 2. Set loose and attached base plates for structural members on adjusting nuts at anchor bolts. All anchor bolts shall have double nuts for adjusting.
 3. Tighten anchor bolts after the supported members have been positioned and plumbed. Do not remove adjusting nuts.
 4. Place non-shrink grout solidly between surfaces as shown to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow non-shrink grout to cure.
- F. Structural steel work shall be set accurately at established lines and levels. Steel shall be plumb and level before final bolting or welding is commenced and after complete erection. All cutting, notching, coping, etc., required for proper assembly and fitting of parts and members, shall be done by the steel fabricator. Such workmanship shall be equal in quality to shop work.
 1. Coordinate the erection of structural steel with other trades and locate temporary guys, braces, falsework and cribbing as may be necessary for erection so as not to interfere with the progress of other work.
 2. Rolled sections, except for minor details, shall not be heated except for welding operations.

3. Upon acceptance by Architect, gas cutting may be permitted if the metal being cut is not highly stressed during the operation. Stresses shall not be transmitted through a flame cut surface unless such surfaces are cut by a mechanically guided torch. The radius of re-entrant flame cut fillets shall be as large as possible, but not less than 1 inch. To determine the net area of members so cut, 1/8 inch shall be deducted from the flame cut edges not made by a mechanically guided torch. Gas cuts shall be smooth and regular. Holes for bolts shall not be cut with a torch.
 4. All contact surfaces shall be cleaned before assembly.
 5. Provide setting diagrams and templates as required. Placement of beam connectors shall be the responsibility of structural steel fabricator.
 6. Splice members only where indicated.
- G. Connections shall be as specified hereinbefore under "Fabrication." In addition, bolted connections shall conform to the following requirements:
1. Beveled washers shall be used under all bolt heads and nuts where they rest on beveled surfaces.
 2. Connectors shall have hexagon heads and nuts.
 3. Nuts shall be drawn up tight. Check threads of unfinished bolts with chisel or approved self-locking nuts.
 4. Bolts that have been completely tightened shall be marked with identifying symbol.
- H. Framing shall be carried up true and plumb. Temporary bracing shall be introduced wherever necessary to take care of all loads to which structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. It shall finally be removed by Contractor as part of his equipment. As erection progresses, the work shall be securely connected to take care of all dead load, lateral loads and erection stresses. No final bolting or welding shall be done until the structure has been properly aligned.

3.03 ERECTION TOLERANCES

- A. Level and plumb steel within the tolerances defined in the AISC Code of Standard Practice, latest edition.

3.04 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint as specified or according to ASTM A780, and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or re-prime field connections, rust spots, abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

3.05 CLEAN-UP

- A. Upon completion of the work of this Section, remove all surplus materials, rubbish and debris from premises.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Steel decking and accessories:
- B. Framing for openings up to and including 24 inches.

1.02 RELATED SECTIONS

- A. Section 05 12 00 – Structural Steel Framing.
- B. Section 09 91 00 – Painting: Paint finish.

1.03 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. AISI S100 – North American Specification for the Design of Cold-Formed Steel Structural Steel Members.
 - 2. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 3. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
 - 4. AWS D1.1 – Structural Welding Code – Steel.
 - 5. AWS D1.3 – Standard Welding Code – Sheet Steel.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings: Indicate decking plan, dimensions, sizes, support locations, projections, openings and reinforcement, pertinent anchoring details and accessories. Coordinate with other trades in accurately locating and detailing openings and penetrations.
- C. Product Data: Provide deck profile characteristics and dimensions, structural properties, finishes and accessories.

D. Manufacturer's Installation Instructions: Indicate specific installation sequence and special instructions.

E. Certificates:

1. The manufacturer's certification and fire test reports to document that deck assemblies comply with requirements of this Section.
2. Furnish certification by approved testing agency for each welder employed.

1.05 PERFORMANCE REQUIREMENTS

A. Steel decking and section properties shall comply with AISI S100.

B. Profile and design of deck units and accessories shall conform to the details shown on Drawings. Units shall be one piece, unless indicated otherwise.

C. Steel decking and its installation shall meet the requirements of 2022 California Building Code (CBC).

1.06 FIELD MEASUREMENTS

A. Verify that field measurements are as shown on shop drawings.

1.07 TESTS AND INSPECTIONS

A. Furnish test specimens of materials when they are requested. Welded decking in place is subject to inspection and testing per CBC Chapter 17A "Special Inspections and Tests", Section 1705A "Required Special Inspections and Tests".

1. Expense of removing and replacing any portion of decking for testing purposes will be borne by Owner if installation is found to be satisfactory. All portions of the work found to be defective and not in conformity with contract requirements shall be removed and replaced at no cost to Owner.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3.

C. Installer: Company specializing in performing work of this Section.

1.09 DELIVERY, STORAGE and HANDLING

A. Deliver products to site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

- C. Store decking on dry wood sleepers; slope for positive drainage. Work showing creases, burrs in cells, deformation, weathering, or other defects affecting its use or appearance in exposed locations will not be accepted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:

- 1. Basis-of-Design: Verco Decking, Inc., Folsom, CA; 916-488-8180, www.vercodeck.com. Product: 3" N deck (HSN3-32-NS) inverted deck.
 - a. UES-ER 2018.

B. Substitutions: Under provisions of Division 01 with valid Evaluation Agency Report.

- 1. Substitution requests for steel decking shall consider the vertical and lateral load capacities of final system, including attachments. Provide a comparison summary of proposed and specified deck systems showing that the proposed system has equal or greater vertical and lateral load capacities for all conditions shown on Drawings. Systems with lower load capacities will not be acceptable.
- 2. Substitution requests will require review by the Structural Engineer of Record and Authority Having Jurisdiction (AHJ). Cost for such reviews shall be borne by Contractor.
- 3. Do not submit shop drawings with substituted decking manufacturer until decking manufacturer has been accepted via substitution request process.

2.02 MATERIALS

- A. Sheet Steel for Bare Deck: ASTM A653/A653M, SS designation, Grade 50 (minimum yield 50 KSI); zinc coated conforming to ASTM A653/A653M, G90, unless noted otherwise. Refer to Drawings for types and sizes of steel decking.
- B. Welding Materials: Conform to AWS D1.1 and D1.3, with a minimum 60 KSI filler metal yield strength.
- C. Shop and Touch-Up Zinc Rich Primer for Galvanized Surfaces: ZRC Galvilite Galvanizing Repair Compound as manufactured by ZRC Worldwide Company, Marshfield, MA; 800-831-3275, www.zrcworldwide.com, or accepted equal.
- D. Steel Decking and Design: Steel decking shall be metallic coated with interlocking side lap. Deck types and minimum structural properties shall be as indicated on Drawings. Submit Evaluation Agency Reports that demonstrate compliance with design requirements.
 - 1. Provide non-vented decking.

2.03 FABRICATION

- A. Fabrication: All steel decking units shall be roll-formed to assure uniformity and strength.
- B. Allowable Tolerances: Maximum variation in unit alignment 1/4 inch in 40 feet (1/1920).

- C. Workmanship: All work shall be neat, trim, true to line and upon completion shall present a true finished surface of specified deck profile, free of dents, deformations, creases, weld spatter or other noticeable defects. Steel deck permanently exposed to view shall be manufactured, handled, and transported for "exposed" installation.
- D. Reinforcement: Provide reinforcement for openings, cutouts and free edges of decking as required for strength and stiffness. Provide reinforcement where a cell is cut parallel to rib as necessary to make a tight fit along the cut cell. Such reinforcement shall be in addition to structural supports shown on Drawings and specified in Section 05 12 00.
- E. Miscellaneous Work: Provide all other transition pieces, reinforcement and miscellaneous decking items as detailed and required to provide a complete installation.
- F. Where steel decking is scheduled to receive a paint finish, it shall be provided free of lubricants, oils, passivators, and other substances which would impair the adhesion of the paint system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work. Check supporting members for correct layout and alignment. Should layout and alignment be such as to prevent proper bearing of the deck units on supporting members, the deck installer shall bring it to the attention of structural steel installer in writing, with a copy to Architect, for corrective measures and action. Steel decking units shall not be placed until necessary corrections are made.
- B. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

- A. Erect steel decking in accordance with Evaluation Agency Report, manufacturer's instructions and final shop drawings.
- B. Placing and Fastening Deck Units: Place decking in a permanent position with all panels aligned end-to-end so that the fluted portions of the panels align accurately. Panels shall be placed on supporting framework and adjusted in final position before being permanently fastened. Ends shall be over structural supports with positive, complete bearing over full width of panels. Installation shall be accomplished without deformation of units. Decking layout shall be as indicated on Drawings.
 - 1. Carefully check control points, as indicated, for layout of deck flutes. Where required, deck module shall be adjusted to conform to layout indicated.
 - 2. Fasten deck units to structure and to each other as indicated.
 - 3. At galvanized steel decks, deslag, clean, and touch-up all welds with zinc-rich primer, including those at the underside of deck.
 - 4. Complete installation shall conform to manufacturer's specifications and as detailed.

- C. Openings Through Decking: Steel decking fabricator shall cut and reinforce all openings in the metal deck, including framed openings indicated on Drawings. Small miscellaneous openings shall be field-cut by the trade requiring the opening.
 - 1. All cutting of exposed edges shall be square, trim and equal to factory cutting.
 - 2. Steel deck panels and accessories shall be cut and neatly fit around openings and other work projecting through the deck.
 - 3. Openings shall be reinforced as indicated or required to provide a rigid installation.
- D. Steel decking installation shall proceed in accordance with current Cal/OSHA and OSHA regulations including guidelines with respect to fall protection.
- E. Steel decking shall be spread for safety and working platforms.
- F. All steel decking sheets shall be wind tacked and loose bundles of deck shall be wired at the end of each shift.

3.03 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field welds will be subject to inspection.
- C. Remove and replace work that does not comply with specified requirements.
 - 1. Additional inspection, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.04 PROTECTION

- A. Do not use steel decking for storage or working platforms until it has been permanently fastened. Storage loads must be supported on wood blocking in the flutes of the deck.
 - 1. Any damaged deck unit shall be repaired or replaced as directed by Architect and at no cost to Owner.
- B. Assure that construction loads do not exceed the carrying capacity of the deck.

3.05 CLEAN-UP

- A. Upon completion of the work of this Section, remove all surplus materials, rubbish and debris from premises.

END OF SECTION

SECTION 05 52 00

METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube railings.
- B. Related Sections include the following:
 - 1. Specification Section 32 13 13 Concrete Work.

1.3 PERFORMANCE REQUIREMENTS

- A. Railing and Handrails: CBC Section 11B-505.
 - 1. Top of gripping surfaces of handrails shall be 34" minimum and 38" maximum vertically above walking surfaces, stair nosings and ramp surfaces. Handrails shall be at a consistent above such surfaces.
 - 2. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1 ½" minimum. Handrail may be located in a recess if the recess is 3" maximum deep and 18" minimum clear above the top of the handrail.
 - 3. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20% of their length. Where provided, horizontal projections shall occur 1 ½" minimum below the bottom of the handrail gripping surfaces.
 - 4. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1-1/4 inches (32 mm) minimum and 2 inches (51 mm) maximum per CBC 11B-505.7.1.
 - 5. Handrail gripping surfaces with a non-circular cross section shall have a perimeter dimension of 4" (102 mm) minimum and 6-1/4" (159 mm) maximum, and a cross-section dimension of 2-1/4" (57 mm) maximum per CBC 11B-505.7.2.
 - 6. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have round edges.
 - 7. Handrails shall not rotate within their fittings.
 - 8. Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with CBC Section 11B-505.10. Such extensions are not required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.

9. A 2" minimum high curb or barrier shall be provided to prevent the passage of a 4" diameter sphere rolling off the sides of a ramp surface. Such a curb or a barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2.
 10. The orientation of at least one handrail shall be in the direction of the stair run, perpendicular to the direction of the stair nosing, and shall not reduce the minimum required width of the stair nosing, and shall not reduce the minimum required width of the stair. CBC Section 11B-505.2.1.
- B. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Structural Performance: Provide railing and handrail assemblies which, when installed, comply with the following minimum requirements for structural performance, unless otherwise indicated.
1. Handrail and Toprails: Capable of withstanding the following loads applied as indicated.
 - a. Uniform load of 50 lbs. per lineal ft. applied simultaneously in both vertical and horizontal directions.
 - b. 200 lbs. concentrated load applied in any direction.

1.4 SUBMITTALS

- A. Product Data: For the following:
1. Manufacturer's product lines of mechanically connected railings.
 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes on stainless steel.
- D. Samples for Verification: For each type of exposed finish required.
1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post,

handrail, and infill. Sample need not be full height.

- a. Show method of finishing, connecting members at intersections.
- E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Qualification Data: For professional engineer.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

- A. Comply with 2022 California Building Code (CBC):
 1. CBC 10 – CBC Chapter 10, Means of Egress.
 2. CBC 11B – CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing.
 3. CBC 16A – CBC Chapter 16A, Structural Design.
 4. CBC 22A – CBC Chapter 22A, Steel.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
 1. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Steel Pipe and Tube Railings:
 - a. Pisor Industries, Inc.

- b. Sharpe Products.
- c. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Castings: Either gray or malleable iron, unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
 - 2. Malleable Iron: ASTM A 47/A 47M.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 2. Provide tamper-resistant or square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors: Provide cast-in-place or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Division 9 Section "High-Performance Coatings."
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections, unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- K. Form changes in direction as follows:
 - 1. By flush bends or by inserting prefabricated flush-elbow fittings.
- L. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- M. Close exposed ends of railing members with prefabricated end fittings.
- N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

- Q. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.
- R. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 - 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with

minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:

1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Do not apply primer to galvanized surfaces.
 2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed

holes of exposed locking screws using plastic cement filler colored to match finish of railings.

- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 - 2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - 3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger.

2. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
3. For steel-framed gypsum board and/or plaster partitions, fasten brackets directly to concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.7 ADJUSTING AND CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.01 SUMMARY

- A. All applicable portions of Division 1, including the drawings and general provisions of the contract, the general and supplementary conditions and Division 1 specification sections which apply to work of this section as if printed herein.
- B. Section Includes:
 - 1. Flashings and counter flashings as indicated on the Drawings and specified herein.
- C. Related Sections:
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Section 07 92 00 – Joint Sealants.
 - 3. Section 09 91 00 – Painting.

1.02 REFERENCES

- A. Fabricate sheet metal items from sheet steel in accordance with ASTM G90.
- B. ASTM A924 / A924M-16ae1 - General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.
- C. FS TT-C 494B – Federal Specification for Coating Compound, Bituminous, Solvent Type, Acid Resistant.
- D. SMACNA - Architectural Sheet Metal Manual, current edition.
- E. AWS - American Welding Society.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings: Indicate locations, configurations, jointing methods, welding methods, fastening methods, expansion joint layouts, downspout layout and installation details.
- C. Samples: Submit two samples, 12 inches long illustrating component design, finish, color, and configuration.

1.04 QUALITY ASSURANCE

- A. Conform to SMACNA Manual for architectural sheet metal flashing and installation details.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Where general flashing pieces are shown on drawings, provide steel sheet metal of at least 22-gauge steel unless otherwise noted on drawings.
- B. Galvanized Steel: ASTM A924 / A924M-09a, Grade A, G90 zinc coating.

2.02 ACCESSORIES

- A. Fasteners and Clips: Provide as required and appropriate for the materials being fastened. Where fasteners or clips may be exposed to outside weather conditions, provide galvanized or stainless-steel type.
 - 1. Provide fasteners such as bolts, screws, and nails hot-dip galvanized as specified in accordance with ASTM A153.
- B. Where rivets will be used, provide malleable iron type with rust-inhibitive coating.
- C. If drive pins are incorporated into work, provide Omark or other approved, cadmium plated with neoprene facing, at least 1-inch long, with neoprene washers.
- D. Solder: For use steel or copper, provide 50 – 50 tin/lead solder (ASTM B32) with rosin flux.
- E. Solder: For use with stainless steel, provide 60 – 40 tin/lead solder (ASTM B32) with acid-chloride type flux, except use rosin flux over tinned surfaces.
- F. Bituminous Coating: SSPC – Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- G. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.
- H. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00 Joint Sealers.
- I. Epoxy Seam Sealer: Two-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.
- J. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

2.03 FABRICATION

A. General Metal Fabrication:

1. Shop fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.
2. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed seams with epoxy seam sealer; rivet joints for additional strength where required.

B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, in edges to be seamed, form seams and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weather/waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from incompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

2.04 PREFABRICATED SHEET METALS

C. Flashing: Provide minimum 22-gauge galvanized flashing to the sizes and shapes as detailed on the drawings. All exposed flashing shall be primed and painted per the paint specification sections. Provide minimum two (2) coats of paint.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Inspect substrate conditions prior to installation of sheet metal items. Conditions which could be detrimental to correct and proper installation of sheet metal assemblies are to be called to the attention of the Owner for their disposition prior to sheet metal work being installed.
- B. Coordinate fabrication and installation of sheet metal items with work of others such as roofing, curtainwall and windows, sealants, mechanical and electrical.

3.02 INSTALLATION

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- C. Joints
 - 1. Typically, provide flat locked joints with sealant between metal surfaces, unless shown otherwise. Where standing seams are required, provide with folded corners.
 - 2. Provide minimum of 3-inch laps.
 - 3. Where concealed joints are possible, provide flat locked joints with 3-inch reinforcing behind, set-in full bed of sealant.
 - 4. Do not leave sheet metal joint unsealed. See sealant section of these specifications.

3.03 INSPECTION

- A. Immediately following installation of sheet metal work, touch-up areas where primer has been removed during installation operations and where soldering has occurred.
- B. Where architectural coatings are provided, touch-up marred or abraded finishes with compatible coating which can be expected to provide the same serviceability as factory applied coatings.

3.04 CLEANING

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

3.05 PROTECTION

- A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Sealants.
- B. Sealant accessories.

1.02 RELATED SECTIONS

- A. Section 04 22 00 – Concrete Unit Masonry.
- B. Section 07 60 00 – Flashing and Sheet Metal.
- C. Section 08 11 00 – Metal Doors and Frames.

1.03 REFERENCES

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only. Refer to Division 01 for definitions, acronyms, and abbreviations.
- B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.
- C. Referenced Standards:
 - 1. ASTM C510 – Standard Test Method for Staining and Color Change of Single or Multicomponent Joint Sealants.
 - 2. ASTM C719 – Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
 - 3. ASTM C794 – Standard Test Method for Adhesion in Peel of Elastomeric Joint Sealants.
 - 4. ASTM C834 – Standard Specification for Latex Sealants.
 - 5. ASTM C881 – Standard Specification for Epoxy Resin Base Bonding Systems for Concrete.
 - 6. ASTM C919 – Standard Practice for Use of Sealants in Acoustical Applications.
 - 7. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
 - 8. ASTM C1087 – Standard Test Method for Determining Compatibility of Liquid Applied Sealants with Accessories Used in Structural Glazing Systems.
 - 9. ASTM C1193 – Standard Guide for Use of Joint Sealants.
 - 10. ASTM C1248 – Standard Test Method for Staining of Porous Substrate by Joint Sealants.
 - 11. ASTM C1311 – Standard Specification for Solvent Release Sealants.
 - 12. ASTM C1521 – Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
 - 13. ASTM D2203 – Standard Test Method for Staining from Sealants.

1.04 SUBMITTALS

- A. General: Submit in accordance with Division 01.
- B. Product Data: Submit manufacturer's descriptive literature and product specification for each product, including primers and sealing compounds.
 - 1. Provide manufacturer's literature with selected colors clearly indicated.
- C. Quality Assurance/Control Submittals:
 - 1. Product validation/assurance submittals.
 - 2. Manufacturer's laboratory adhesion and stain testing results.
 - 3. Joint sealants field adhesion to joint substrates test results.
 - 4. Installer qualifications.
 - 5. Written certification from the subcontractor that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.
- D. Sample Manufacturer's Warranty.
- E. Closeout Submittals: Cleaning and maintenance data.

1.05 DEFINITIONS

- A. Sealant Types:
 - 1. S: Single component sealant, cures by moisture reaction.
 - 2. M: Multiple component sealant; cures by chemical reaction.
- B. Sealant Grades:
 - 1. NS: Non-sag or gunnable sealant that permits application in joints on vertical surfaces without sagging or slumping.
 - 2. P: Pourable sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
 - 3. SL: Self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
- C. Sealant Classes:
 - 1. 12.5: A sealant that when tested for adhesion and cohesion under cyclic movement shall withstand an increase and decrease of at least 12.5 percent of the joint width as measured at the time of application.
 - 2. 25: A sealant that when tested for adhesion and cohesion under cyclic movement shall withstand an increase and decrease of at least 25 percent of the joint width as measured at the time of application.
 - 3. 35: A sealant that when tested for adhesion and cohesion under cyclic movement shall withstand an increase and decrease of at least 35 percent of the joint width as measured at the time of application.

4. 50: A sealant that when tested for adhesion and cohesion under cyclic movement shall withstand an increase and decrease of at least 50 percent of the joint width as measured at the time of application.
5. 100/50: A sealant that when tested for adhesion and cohesion under cyclic movement shall withstand an increase of at least 100 percent and a decrease of at least 50 percent of the joint width as measured at the time of application.

D. Sealant Uses:

1. A: Sealant acceptable for use on an aluminum substrate.
2. G: Sealant acceptable for use on a glass substrate.
3. I: Sealant designed for use in joints which are submerged continuously in a liquid.
 - a. Immersion rated sealant applications require primer.
4. M: Sealant acceptable for use on a mortar substrate.
5. NT: Sealant designed for use in joints in non-traffic areas.
6. T: Sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks, and parking garages.
7. O: Sealant acceptable for use on substrates other than those listed above including, but not limited to, color anodized aluminum, metals other than aluminum, painted surfaces, brick, stone, tile, and wood.

E. Miscellaneous:

1. FC: Fast cure sealants; provides lesser cure times than corresponding standard cure sealants.

1.06 SUSTAINABLE DESIGN REQUIREMENTS

- A. Meet VOC requirements of South Coast Air Quality Management District (SCAQMD) Rule 1168. Information is available at www.aqmd.gov. VOC limit expressed in grams per liter as follows:

Sealant	VOC Limit
Architectural	250
Other	420

Sealant Primer	VOC Limit
Architectural – Nonporous	250
Architectural - Porous	775
Other	750

- B. Provide sealants with no carcinogen or reproductive toxicant components at more than one percent of total mass of product as defined in the following lists:
1. California OEHHA, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Information is available at www.oehha.ca.gov/prop65.html.
 2. California Air Resources Board (CARB), list of Toxic Air Contaminants (California Air Toxics). Information is available at www.arb.ca.gov/toxics.

1.07 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Firm specializing in manufacturing products specified in this Section.
2. Applicator Qualifications: Firm specializing in installing work specified in this Section with experience on at least five projects of similar nature in past three years.

B. Product Validation/Assurance: Provide products with current SWRI Validation or provide independent third-party laboratory test results showing product meets performance requirements in accordance with ASTM C920 and as specified in this Section.

C. Compatibility: Materials forming joints and adjacent materials shall not adversely affect sealant materials or sealant color per ASTM C1087.

D. Staining: Sealants shall not stain joint substrates per ASTM C510, ASTM C1248, and ASTM D2203.

E. Manufacturer Adhesion, Cohesion, and Stain Testing: Provide manufacturer's laboratory adhesion and cohesion testing per ASTM C719 and ASTM C794, and stain testing per ASTM C510, using specimens of actual substrates to ensure sealant compatibility with substrate before product acceptance.

F. Joint Sealants Field Test for Adhesion and Cohesion to Joint Substrates: Perform field tests for each elastomeric joint sealant in accordance with ASTM C1521, with the manufacturer's representative present prior to installation as follows:

1. Install joint sealants in five foot joint lengths. Allow sealant to fully cure before testing.
2. Make a knife cut of the sealant across the joint and along each side of the joint approximately 3 inches long.
3. Place a mark on the sealant tab, 1 inch from the adhered joint to the tab's free end.
4. Grasp a 2 inch piece of sealant firmly just beyond the 1 inch mark and pull at a 90 degree angle.
5. Record whether or not sealant in joint maintained adhesion to substrate.
6. Record percentage length of sealant elongation.
7. Sealant product acceptance shall be based on pass/fail adhesion performance.

G. Coordination: Coordinate work in this Section with work in related Sections.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Division 01.

B. Deliver materials in the unopened, original containers or unopened packages with manufacturer's name, labels, product identification, color, expiration period, curing time and mixing instructions for multi-component materials.

C. Storage and Protection: Store materials in a dry secure location with ambient temperature range of 60 degrees F to 80 degrees F.

D. Carefully handle and store to prevent inclusion of foreign materials.

1.09 PROJECT/SITE CONDITIONS

A. Environmental Limitations:

1. Do not proceed with installation of primers and joint sealants under the following conditions:
 - a. When ambient and substrate temperature conditions are less than 40 degrees F, or as otherwise recommended by manufacturer.
 - b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.10 SEQUENCING

- A. Apply waterproofing, water repellents, and preservative finishes after sealants have fully cured.

1.11 WARRANTY

- A. Comply with provisions of Division 01.

- B. Provide manufacturer's warranty against material defects, air and water tightness, loss of adhesion, cohesion, and staining as follows:

1. Silicone sealants – Twenty years.
2. Urethane sealants – Five years.
3. Other sealants – Two years.

- C. Provide installer's two year workmanship warranty.

1.12 MAINTENANCE DATA

- A. Submit in accordance with Division 01.

- B. Provide cleaning and maintenance information, recommended inspection intervals, and instructions for repairing and replacing failed sealant joints.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

1. BASF Corporation – Building Systems, Shakopee, MN; 800-433-9517 www.buildingsystems.basf.com.
2. Pecora Corporation, Harleysville, PA; 800-523-6688, www.pecora.com.
3. Sika Corporation, Lyndhurst, NJ; 800-933-7452, www.usa.sika.com.
4. The Dow Chemical Company, Midland, MI; 800-331-6451, www.consumer.dow.com.
5. Tremco Sealant Weatherproofing Division of RPM International, Inc., Beachwood, OH; 800-321-7906, www.tremcosealants.com.

B. Substitutions: Under provisions of Division 01.

2.02 SEALANTS

A. General:

1. Provide sealants that have been tested and found suitable for the substrates to which they will be applied.
2. Color: As selected by Architect from manufacturer's full range of colors.

B. Exterior Sealants:

1. Exterior Perimeter Sealant: Polyurethane sealant; ASTM C920; Type M; Grade NS; Class 50; uses: A, I, M, NT, O, T.
 - a. Products:
 - 1) Tremco Dymeric 240FC.
 - 2) BASF MasterSeal NP2.
 - 3) Sika Sikaflex-2c NS.
 - 4) or accepted equal.
 - b. Use at:
 - 1) Exterior vertical joints bordered on one or both sides by concrete, metal, and/or sheet metal flashing lap joints.
 - 2) Porous materials such as concrete or masonry.
 - 3) Non-porous materials such as painted metal.
2. Exterior Perimeter Sealant: Medium modulus moisture curing, non-staining, non-bleeding silicone sealant; ASTM C920; Type S; Grade NS; Class 50/50; uses: A, G, M, NT, O.
 - a. Products:
 - 1) The Dow Chemical Company Dowsil 795 Silicone Building Sealant.
 - 2) Tremco Spectrum 2.
 - 3) Sika Sikasil WS-295.
 - 4) or accepted equal.
 - b. Use at:
 - 1) Exterior vertical joints bordered on one or both sides by concrete, metal, and/or sheet metal flashing lap joints.
 - 2) Porous materials such as concrete or masonry.
 - 3) Non-porous materials such as painted metal.
3. Traffic Sealant: Self leveling, chemical curing, non-staining, non-bleeding polyurethane sealant; ASTM C920; Type M; Grade NS or Grade P; Class 25; uses: M, O, T.
 - a. Products:
 - 1) Pecora Corp. Urexpan NR-200.
 - 2) BASF MasterSeal SL 2.
 - 3) Sika Sikaflex-2c SL.
 - 4) or accepted equal.
 - b. Use at:
 - 1) Exterior horizontal traffic expansion joints in concrete with slopes less than five percent.
4. Traffic Sealant: Slope grade chemical curing, non-staining, non-bleeding polyurethane sealant; ASTM C920; Type M; Grade P; Class 25; use: T.

- a. Products:
 - 1) Pecora Corp. DynaTrol II-SG.
 - 2) BASF MasterSeal SL 2 Slope Grade.
 - 3) Sika Sikaflex 2c NS TG.
 - 4) or accepted equal.
 - b. Use at:
 - 1) Exterior horizontal traffic expansion joints in concrete with slopes between five percent and ten percent.
5. Metal Lap and Bedding Sealant (non-soldered flashings): Non-drying, non-skinning, non-curing flexible butyl rubber sealant; ASTM C1311; Type S; Grade NS; Class 10; uses: G, M, O.
- a. Products:
 - 1) Tremco TREMpro JS773 Butyl Sealant.
 - 2) Pecora Corp. BA-98 Butyl Rubber Sealant.
 - 3) or accepted equal.
 - b. Use for bedding thresholds, glazing secondary seals, and sheet metal flashing and trim not exposed to ultraviolet (UV) light.
6. Metal Lap and Bedding Sealant (non-soldered flashings): High performance, moisture curing, gun grade polyurethane sealant; ASTM C920; Type S; Grade NS; Class 25; use: A, I, M, NT, O, T.
- a. Products:
 - 1) Tremco Vulkem 116.
 - 2) BASF MasterSeal TX1.
 - 3) Sika Sikaflex Textured Sealant.
 - 4) or accepted equal.
 - b. Use for bedding thresholds, glazing secondary seals, and sheet metal flashing and trim exposed to ultraviolet (UV) light.

2.03 ACCESSORIES

- A. Joint Cleaner: Non-corrosive and non-staining type as recommended by sealant manufacturer; compatible with joint forming materials.
- B. Primers: Non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.
- C. Joint Backing: Non-adhering backing to sealant; non-staining, compatible with sealant and primer such as round, closed cell or bi-cell polyethylene foam rod; oversized 25 percent to 50 percent larger than joint width. Materials impregnated with oil, bitumen or similar materials are not permitted.
- D. Bond Breakers: Type and consistency recommended by the sealant manufacturer to suit the particular application.
- E. Bond Breaker Tape: Self-adhesive, pressure sensitive polyethylene tape.
- F. Masking Tape: Non-staining, non-absorbent tape compatible with joint sealants and adjacent joint surfaces.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine job site conditions; verify substrate, surfaces, and joint openings are ready to receive work and field measurements are as shown on drawings, as specified in this Section, and as recommended by manufacturer.
- B. Report unacceptable conditions to Architect. Begin installation only when unacceptable conditions have been corrected.

3.02 PREPARATION

- A. Clean, prepare, and prime joints in accordance with ASTM C1193 and manufacturer's written instructions.
- B. Remove loose materials and foreign matter that might impair sealant adhesion. Clean porous materials such as concrete or masonry by grinding, sand or water blast cleaning, mechanical abrading, acid washing or a combination of these methods as required to provide a clean, sound base surface for sealant adhesion.
 - 1. Remove laitance by acid washing, grinding or mechanical abrading.
 - 2. Remove form oils, release agents, chemical retardants, by sand or water blast cleaning.
 - 3. Blow from joints with oil-free compressed air loose particles resulting from grinding, abrading, or blast cleaning prior to sealant application.
- C. Mechanically or chemically clean nonporous surfaces such as metal. Remove temporary protective coatings on metallic surfaces using solvents that leave no residue as recommended by metal surface manufacturer. When masking tape or strippable films are used, remove the tape or film and clean any residual adhesive. Apply and wipe-dry cleaning solvents using clean, lint-free cloths or paper towels, do not allow solvent to air dry without wiping.
- D. Protect elements surrounding the work of this Section from damage or disfiguration. Apply masking tape to adjacent surfaces to prevent damage to finishes from sealant installation.

3.03 APPLICATION

- A. Apply sealants in accordance with ASTM C1193, manufacturer's written instructions, and accepted shop drawings.
- B. Apply acoustical sealants in accordance with ASTM C919, manufacturer's written instructions, except where more stringent requirements are specified herein, and accepted shop drawings.
- C. Apply sealant where indicated on the Drawings and at all exterior joints and openings in the building envelope that are observable sources of air or water infiltration.

- D. Measure joint dimensions and size materials to achieve required width-to-depth ratios. Acceptable joint width-to-depth ratios:

Material	Joint Width	Joint Depth	
		Minimum	Maximum
Metal or other nonporous surfaces.	1/4 inch (minimum)	1/4 inch	1/4 inch
	Over 1/4 inch	1/2 of width	1/2 inch
Wood, concrete, masonry, or other porous surfaces.	1/4 inch (minimum)	1/4 inch	1/4 inch
	Over 1/4 inch	1/2 of width	1/2 inch
	Over 1/2 to 2 inches	1/2 inch	1/2 inch
	Over 2 inches	As recommended by sealant manufacturer.	

- E. Install joint backing to achieve desired joint width-to-depth ratio. Roll the material into the joint to avoid lengthwise stretching. Do not twist or braid rod stock.
- F. Install bond breaker where joint backing is not used to prevent three-sided adhesion.
- G. Apply primer where required and where recommended by sealant manufacturer for sealant adhesion.
- H. Install sealants within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- I. Install sealants immediately after joint preparation.
- J. Install sealants free of air pockets, foreign embedded matter, ridges, and sags.
- K. Produce uniform, cross sectional shapes and depths relative to joint width that allow optimum sealant movement capability.
- L. Tool joints concave. Use dry tooling method.
- M. Cure sealants in compliance with their manufacturer's instructions to obtain high early bond strength, internal cohesive strength, and durability. Do not disturb seals until completely cured.

3.04 CLEANING AND REPAIRING

- A. Immediately clean work under provisions of Division 01.
- B. Clean adjacent soiled surfaces. Use a cleaning agent as recommended in writing by the sealant manufacturer. Remove any masking tape immediately after tooling joints, leaving finished work in neat and clean condition.
- C. Repair or replace defaced or disfigured caused by work of this Section.

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished installation under provisions of Division 01.

- B. Protect sealant until cured.
- C. Do not paint sealants until sealant is fully cured.
- D. Do not paint silicone sealant.
- E. Protect joint sealants from contact with contaminating substances and from damage. Cut out, remove and replace contaminated or damaged sealants, immediately, so that they are without contamination or damage at time of Project Completion.

END OF SECTION

SECTION 08 11 00

METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Non-rated rolled steel doors, panels, and frames.
2. Louvers.

B. Referenced Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 04 22 00 – Concrete Unit Masonry.
3. Section 09 91 00 – Painting.

1.02 REFERENCES

- A. ANSI A250 .8 – Recommended Specification for Standard Steel Doors and Frames.
- B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.
- C. ANSI A250 .10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- D. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot- Dip Process.
- E. ASTM A924 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- F. SDI-105 - Recommended Erection Instructions for Steel Frames.
- G. DHI - Door and Hardware Institute.
- H. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2 and Part 6.

1.03 QUALITY ASSURANCE

- A. Conform to requirements of ANSI A250.8.

- B. Installed exterior frame and door assembly to be weather tight
- C. Manufacturer shall have both fabrication and assembly plant located within the continental United States or Canada. Products that are either fabricated or assembled outside the continental United States or Canada are not acceptable.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish.
- C. Indicate door elevations, internal reinforcement, closure method, and cut outs for louvers.
- D. Submit two (2) samples of exterior frame profile at mullion intersection.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect, and handle products under provisions of Section 016200.
- B. Store products on site under cover.
- C. Place products on at least 4-inch wood sills to prevent rust and damage.
- D. Protect doors and frames with resilient packaging.

1.08 SEQUENCING AND SCHEDULING

- A. Sequence work under the provisions of Section 01 32 13.
- B. Schedule work under the provisions of Section 01 32 13.
- C. Schedule delivery of all doors and frames so as not to delay progress of other trades.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Amweld Building Products, Inc., www.amweld.com.
- B. Curries Mfg. Inc., www.curries.com.
- C. Door Components, Inc., www.doorcomponents.com.

- D. Fleming, www.flemingdoor.com.
- E. Krieger Steel Products Company, www.kriegersteel.com.
- F. Republic Builders Products Corporation, www.republicdoor.com.
- G. Curries, www.curries.com.
- H. Ceco, www.cecodoor.com.
- I. Substitutions: Under provisions of Section 01 25 13.

2.02 MATERIALS

A. Doors, Panels and Frames

1. Steel: Commercial quality cold rolled steel conforming to ASTM A653 galvanized to A60 or G60 coating class or Type 8, A40 (ZF120) according to ASTM A924 with minimized spangle, mill phosphatized.
2. Exterior Doors: ANSI A250.8, Level 3, extra heavy-duty, Model 2, continuous welded seam, minimum 0.053-inch-thick faces (16 GA. Minimum).
3. Exterior Frames: ANSI A250 .8, Level 3, 0.067-inch-thick material (14 GA. Minimum), core thickness.
4. Panels: Same materials and construction as specified for doors.

B. Door Core

1. Exterior Core: Polystyrene insulation.

C. Closer Channels

1. Close top and bottom edge of exterior door flush with inverted steel channel closure. Weld all joints watertight.

D. Frame Anchors

1. Masonry Anchors: Adjustable T-strap, 0.053-inch-thick steel, corrugated, 2-inch x 10-inch size. Fire rated frames to have UL listed perforated strap anchor permanently anchored to frame.
2. Floor Clip: Angle anchor, full width of frame, 0.067-inch-thick steel.

E. Protective Coatings

1. Bituminous Coating: Fibered asphalt-based corrosion proofing and sound deadener compound. Equivalent to Transcoat 101-F, www.oilservice.com.

2. Primer: Clean and treat with three stage iron phosphate process. Provide baked-on shop coat of EPA compliant gray synthetic rust - inhibitive enamel primer meeting acceptance criteria of ANSI 250.10.

F. Hardware Reinforcement

1. Fabricate frames and doors with hardware reinforcement plates welded in place.
2. Hinge reinforcing shall be full width of frame profile.
3. Provide spacers for all thru-bolted hardware.
4. Reinforcement components shall be the following minimum thickness:
5. Hinge (door and frame) 3/16 inch
6. Mortise Lock or Deadbolt 0.093 inch
7. Bored Lock or Deadbolt 0.093 inch
8. Flush Bolt Front 0.093 inch
9. Surface Bolt 0.093 inch
10. Surface Applied Closer 0.093 inch
11. Hold Open Arm 0.093 inch
12. Pull Plates and Bars 0.067 inch
13. Surface Exit Device 0.093 inch
14. Floor Checking Hinge 0.167 inch
15. Pivot Hinge 0.167 inch

2.03 ACCESSORIES

- A. Door Louvers: 18-gauge, non-vision, inverted split "Y louver with 12-gauge security grille two sides, prime coat finish for field painting. Provide optional galvanized attached mesh insect screen. Size as shown on Drawings.
 1. Anemostat security door louvers, model #PLSL.
 2. Air Louvers Inc., Model 1500-A.
- B. Rubber Silencers: Resilient rubber.

2.03 FABRICATION

- A. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing.
- B. All spliced joints shall occur on the interior side of exterior frames.
- C. Fabricate frames as full profile welded units.
- D. All face, rabbet and soffit joints between abutting members shall be continuously welded and finished smooth when exposed to exterior.
- E. Corner joints shall have all contact edges closed tight, with faces mitered and continuously welded.

- F. Frames with multiple openings shall have mullion members fabricated with no visible seams or joints. All face, rabbet and soffit joints between abutted members shall be continuously welded and finished smooth when exposed to exterior.
- G. Provide 3/8-inch back bend return on frames where gypsum board wall material occurs whether on one or both sides.
- H. Prepare frame for silencers except for frames which receive weatherstripping. Provide three (3) single rubber silencers for single doors on strike side, and two (2) single silencers on frame head at double doors without mullions.
- I. Provide steel spreader temporarily attached to feet of both jambs as a brace during shipping and handling. Spreader is not to be used for installation purposes.
- J. Manufacturing Tolerances
 - 1. Manufacturing tolerance shall be maintained within the following limits:
 - 2. Frame width +1/16 inch -1/32 inch
 - 3. Frame height +-3/64 inch
 - 4. Frame face +-1/32 inch
 - 5. Frame stop +-1/32 inch
 - 6. Frame rabbet +-1/64 inch
 - 7. Frame depth +-1/32 inch
 - 8. Frame throat +-1/16 inch
 - 9. Door width and height +-3/64 inch
 - 10. Door thickness +-1/16 inch
 - 11. Hardware location +-1/32 inch
 - 12. Door flatness +-1/16 inch

2.4 FINISHES

- A. Primer: Baked on rust-inhibitive enamel.
- B. Finish: Site paint under provisions of Section 09 91 00.
- C. Coat inside of frame profile for frames installed in masonry construction with bituminous coating to a thickness of 1/16 inch. Coating may be factory or site applied. Do not apply coating to fire rated frames.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install frames in accordance with SDI-105.
- B. Install doors in accordance with DHI.

- C. Installation of exterior doors and frames to be weathertight and waterproof.
- D. Seal penetration of all surface applied screws on exterior face of frames at hardware attachments.
- E. Coordinate with wall construction and details for anchor placement. Provide anchors as follows:
- F. Frames up to 7 feet 6 inches height - 4 anchors each jamb.
- G. Frames 7 feet 6 inches to 8 feet 0-inch height - 5 anchors each jamb, plus an additional anchor for each 2 feet or fraction thereof over 8 feet 0 inch.
- H. Floor anchors - one (1) anchor each jamb for interior doors. Where wall construction will not allow placement of floor anchor, provide one (1) additional jamb anchor as close to floor as possible.
- I. Frames installed in masonry walls to be fully grouted with masonry grout.
- J. Exposed field welds to be finished smooth and touched up.
- K. Primed or painted surfaces which are scratched or marred shall be touched up.
- L. Hardware to be applied in accordance with hardware manufacturer's templates and instructions.
- M. Install door louvers.
- N. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

3.02 CONSTRUCTION

A. INSTALLATION TOLERANCES

1. Edge clearance for swinging doors shall not exceed the following:
 - a. Between door and frame at head and jamb: 1/8 inch.
 - b. At door sill with threshold. (From bottom of door to top of threshold): 3/8 inch.
 - c. At door sill with no threshold: 1/2 inch.
2. Frame installation tolerance shall not exceed the following:
 - a. Squareness $\pm 1/16$ inch.
 - b. Alignment $\pm 1/16$ inch.
 - c. Plumbness $\pm 1/16$ inch.
 - d. Diagonal Distortion $\pm 1/32$ inch.

END OF SECTION

SECTION 09 91 00

PAINING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface preparation.
2. Products and application.
3. Surface finish schedule.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 05 12 00 – Structural Steel Framing.
3. Section 07 60 00 – Flashing and Sheet Metal.
4. Section 08 11 00 – Metal Doors and Frames.

1.02 REFERENCES

- A. ASTM D16 – Standard Terminology for Paint, Related Coatings, Materials, and Applications.

1.03 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.04 SYSTEM DESCRIPTION

- A. Preparation of all surfaces to receive final finish.
- B. Painting and finishing work of this section using coating systems of materials including primers, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.
- C. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
- D. Painting and finishing all exterior and interior surfaces of materials including structural, mechanical, and electrical work on site.
- E. Paint exposed surfaces except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.

1.05 SUBMITTALS

- A. Submit product data under provisions of Section 01 33 00.
- B. Provide manufacturer's technical information and instructions for application of each material proposed for use by catalog number.
- C. List each material by catalog number and cross-reference specific coating with specified finish system.
- D. Provide manufacturer's certificate that products proposed meet or exceed specified materials.
- E. Submit samples under provisions of Section 01 33 00.
- F. Submit two (2) samples 8-1/2 x 11 inch in size of each paint color and texture applied to cardboard. Resubmit samples until acceptable color, sheen and texture is obtained.

1.06 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five (5) years' experience.
- B. Applicator: Company specializing in commercial painting and finishing with five (5) years documented experience.
- C. Regulatory Requirements
 - 1. Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions.
 - 2. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).
 - 3. Coats: The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number of coats, apply such additional coats as are necessary to produce the required finish.
 - 4. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer.
 - 5. Provide primers and undercoat paint produced by the same manufacturer as the finish coat.
- D. Field Samples
 - 1. Provide field samples under provisions of Section 01 33 00.
 - 2. On wall surfaces and other exterior and interior components, duplicate specified finishes on at least 100 sq. ft. of surface area.
 - 3. Provide full-coat finishes until required coverage, sheen; color and texture are obtained.
 - 4. Simulate finished lighting conditions for review of field samples.

5. After finishes are accepted, the accepted surface may remain as part of the work and will be used to evaluate subsequent coating systems applications of a similar nature.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site and store and protect under provisions of Section 01 66 00.
- B. Deliver products to site in sealed and labelled containers; inspect-to verify acceptance.
- C. Full unopened 1 GAL can (new) - Container labelling to include paint Formula, manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing. Paint containers not displaying product identification will not be acceptable.
- D. Store paint materials at minimum ambient temperature of 50 degrees F and a maximum of 90 degrees F, in well-ventilated area, unless required otherwise by manufacturer's instructions.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.08 PROJECT CONDITIONS

- A. Environmental Requirements
 1. Provide continuous ventilation and heating facilities to maintain interior surface and ambient temperatures above 50 degrees F with a maximum humidity level of 50 percent for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
 2. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.
 3. Minimum Application Temperatures for Latex Paints: 50 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
 4. Provide lighting level of 80 feet candles measured mid-height at substrate surface.

1.09 OWNER'S INSTRUCTIONS

- A. Extra Material
 1. If product used was SCUSD Paint shop's #1 choice listed in these technical specs, please provide 1-quart only unopened container of each color and surface texture to Owner along with physical draw down and formula; however, if any other product other than our first choice is used, do not provide any attic stock and instead only provide physical draws with formula for each color used.
 - a. Separate draw downs and formula are required for each paint product, color, and sheen used.
 2. Label each container with paint mixture formula, color, texture, and room locations in addition to the manufacturer's label.

1.10 WARRANTY

- A. All "Deep Tone" colors shall be warranted for 10-year color retention with a delta loss of no more than 75 cie lab units.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Unless specifically identified otherwise, product designations included at end of section are those of the Dunn Edwards, www.dunnedwards.com and shall serve as the standard for kind, quality, and function.
- B. Subject to compliance with requirements, other manufacturers offering equivalent products are:
 - 1. Dunn Edwards, www.dunnedwards.com.
 - 2. Kelly Moore, <https://kellymoore.com/professional/contractors/>
 - 3. Sherwin Williams, <https://www.sherwin-williams.com/painting-contractors/project-solutions/commercial>
- C. Substitutions: Under provisions of Section 01 25 13.

2.02 MATERIALS

- A. Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
- B. Good flow and brushing properties; capable of drying or curing free of streaks or sags.
- C. "Deep Tone" colors to be composed of 100 percent acrylic pigments, factory ground, with a colored base.
- D. Accessory Materials: Materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
- E. Chemical Components of Interior Paints and Coatings: Shall not exceed the limitations of Green Seal's Standard GS-11 for VOC content and the following restrictions:
 - 1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
 - 2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
 - 3. Anticorrosive Coatings: VOC content of not more than 250 g/L.

- F. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
- G. Restricted Components: Paints and coatings shall not contain any of the following:
 - 1. Acrolein.
 - 2. Acrylonitrile.
 - 3. Antimony.
 - 4. Benzene.
 - 5. Butyl benzyl phthalate.
 - 6. Cadmium.
 - 7. Di (2-ethylhexyl) phthalate.
 - 8. Di-n-butyl phthalate.
 - 9. Di-n-octyl phthalate.
 - 10. 1, 2-dichlorobenzene.
 - 11. Diethyl phthalate.
 - 12. Dimethyl phthalate.
 - 13. Ethylbenzene.
 - 14. Formaldehyde.
 - 15. Hexavalent chromium.
 - 16. Isophorone.
 - 17. Lead.
 - 18. Mercury.
 - 19. Methyl ethyl ketone.
 - 20. Methyl isobutyl ketone.
 - 21. Methylene chloride.
 - 22. Naphthalene.
 - 23. Toluene (methylbenzene).
 - 24. 1, 1, 1-trichloroethane.
 - 25. Vinyl chloride.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 - 1. Concrete Unit Masonry 12 percent.

3.02 PREPARATION

A. Work Not to Be Painted

1. Painting is not required on surfaces in concealed and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.
2. Do not paint metal surfaces such as stainless steel, chromium plate, brass, bronze, and similar finished metal surfaces.
3. Do not paint anodized aluminum or other surfaces which are specified to be factory pre-finished.
4. Do not paint sandblasted or architecturally finished concrete surfaces.
5. Do not paint prefinished acoustic materials or acoustic suspension systems.
6. Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or identifications.
7. Do not paint exterior hot-dipped galvanized materials/products as specified elsewhere.

B. Surface Preparation

1. Remove all tacks, stickers, staples adhesive glue, picture hangers, protruding nails, tape and adhesive glue, and all other foreign materials from surfaces prior to priming or painting. Mask off and protect existing room identification tags including Asbestos tags on door frames.
2. All exterior surfaces to be painted will be pressure washed to remove all loose paint, blisters, bridged cracks, surface-chalk and loose debris at no less than 3200-PSI, or sand blasted.
3. If prior is not possible, washing all surfaces with TSP made by Synco or Jasco, by hand means, scraping and sanding of all surfaces is required prior to pre-priming for proper patching and painting of surfaces.
4. Prior to any painting, any metal deficiencies should be replaced including but not limited to, doors, trim etc.
5. All glossy surfaces WILL be sanded prior to any paint application. NO EXCEPTIONS.
6. Clean all roofing tar from facial boards and metal flashing etc.
7. All factory primed new material metal etc, will be sanded prior to priming and painting.
8. All surfaces to be patched will be pre-primed with the proper material as per manufacture specifications for substrate.
9. Any efflorescence will be primed as per Dunn-Edwards EFF-Stop concrete and masonry filler manufactures specifications.
10. Wash all doors, casings and other surfaces with TSP made by Synco or Jasco to remove oily dirt, dust, smoke, and other residues that could prevent proper adhesion of any paint products.
11. For all fillers and patching compounds used, surfaces will be primed before, after application, and before finish paint being applied.
12. All prep work will be done like the SCUSD standard NO EXCEPTIONS. This includes patching, scraping, sanding, caulking, and removal of all drips, sags, runs and removal of all foreign matter on or in painted surface.

3.03 APPLICATION

- #### A. Apply products in accordance with manufacturer's instructions.

- B. Do not apply finishes to surfaces that are not dry.
- C. Apply prime coat to surfaces which are to be painted or finished.
- D. Apply each coat to uniform finish.
- E. Sand lightly between coats to achieve required finish.
- F. Allow applied coat to dry according to the Manufacturers Specifications before the next coat is applied.
- G. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
- H. Paint mill finished door seals to match door or frame.
- I. Cloudiness, spotting, lap marks, brush marks, runs, sags, spikes and other surface imperfections will not be acceptable.
- J. Where spray application is used, apply each coat of the required thickness. Do not double back to build up film thickness of two (2) coats in one pass.
- K. Where roller application is used, roll and redistribute paint to an even and fine texture. Leave no evidence of roller laps, irregularity of texture, skid marks, or other surface imperfections.
- L. Finishing Electrical Equipment:
 - 1. Refer to Division 26 for schedule of color coding and identification banding of equipment and conduit.
 - 2. Paint shop primed equipment. Do not paint shop prefinished items.
 - 3. Remove unfinished louvers, grilles, covers, and access panels on electrical components and paint separately.
 - 4. Prime and paint conduit, boxes, hangers, brackets, collars and supports, except where items are prefinished.
 - 5. Replace identification markings on electrical equipment when painted accidentally.
 - 6. Paint exposed conduit and electrical equipment occurring in finished areas with existing matching wall color.
 - 7. Color code equipment and conduit in accordance with requirements indicated.
 - 8. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.
 - 9. Do not paint moving parts of operating units; electrical parts such as valve operators; linkages; sensing devices; and motor shafts.
 - 10. Do not paint over labels or equipment identification markings.
 - 11. Do not paint switch plates, light fixtures, and fixture lenses.

3.04 CONSTRUCTION

A. Priming:

1. All new or bare galvanized metal will first be etched and then primed with appropriate galvanized latex or oil base primer, use cleaner and primer measures as per manufactures specification.
2. All door and Casings may be sprayed. Doors may also be tight rolled with a 3/8th inch nap roller. All casings to be brushed or laid off with a brush. ABSOLUTELY NO EXCEPTIONS.
3. All holes and cracks are to be filled with the proper exterior patching compound and latex caulking with silicone.
4. All rusty ferrous and ferrous metal are to be primed with a rust-inhibitive red, gray or white oxide all galvanized metal will be primed with a galvanized primer.

B. Finish Coat

1. All existing walls and overhangs to be coated with 100% acrylic exterior eggshell exterior paint.
2. All fascia boards to be coated with 100% acrylic exterior semi-gloss paint.
3. All metal poles, ungalvanized OR painted handrails, and iron gates are to be finished in water-borne alkyd urethane semi-gloss finish paint.
4. All doors and casings to have water-borne alkyd urethane finish, including tops, bottoms, and proper edges of doors and casings according to trade standards. All doors can be sprayed or tight rolled with a 3/8th inch nap roller or sprayed. All Casings must have sprayed or brushed finishes. NO EXCEPTIONS.
5. All trim finishes are to be done in water-borne alkyd urethane semi-gloss paint.
6. All colors and product material to be used are to be APPROVED by the SCUSD paint shop Supervisor before application NO EXCEPTIONS.

3.05 REPAIR/RESTORATION

A. PATCHING

1. After completion of painting in any one room or area, repair surfaces damaged by other trades.
2. Touch-up or re-finish as required to produce intended appearance.

3.06 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 00.
- B. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary.
- C. The Owner will engage the services of an independent testing agency to sample paint material being used.
- D. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

- E. The testing agency will perform appropriate quantitative materials analysis and other characteristic testing of materials as required by the Owner.
- F. If test results show materials being used and their installation do not comply with specified requirements or manufacturer's recommendations, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing and repaint surfaces to acceptable condition.

3.07 CLEANING

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.08 PROTECTION OF COMPLETED WORK

- A. Protect finished installation under provisions of Division 01.
- B. Erect barriers and post warning signs. Maintain in place until coatings are fully dry.
- C. Confirm that no dust generating activities will occur following application of coatings.

3.09 SCHEDULES

- A. Color Schedule Guidelines
 - 1. Paint and finish colors shall be selected by the Architect from manufacturer's entire range to match District standard colors or compliment those colors with the approval of the SCUSD Paint Shop Supervisor.
 - 2. Electrical conduit and electrical panels: Generally, the same color as adjacent walls.
 - 3. Exterior steel doors, frames and trim: Generally, a contrasting color to adjacent walls.
 - 4. Doors generally are all the same color, but of a contrasting color from frame and trim.
 - 5. Exterior steel fabrications: Generally, a contrasting color to adjacent walls.
 - 6. Ceilings are generally to be painted a different color than walls.
- B. Exterior Painting Schedule
 - 1. CMU Substrates:
 - a. Prime Coat: Block filler, latex, interior/external, Dunn-Edwards, Smooth BLOCFIL Select SBSL00 or Eff-Stop Premium ESPR00.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, eggshell, Dunn-Edwards, Evershield, EVSH30, 100% acrylic, (Gloss Level 3).
 - Or

- d. Topcoat: Latex, exterior, low sheen, Dunn-Edwards, Evershield, EVSH40, 100% acrylic, (Gloss Level 4).
2. Ferrous Metal Substrates:
 - a. Waterborne Urethane Alkyd Enamel System:
 - 1) Prime Coat: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Bloc-Rust Premium BRPR00 Series or Enduraprime rust preventative primer ENPR00.
 - 2) Intermediate Coat: Waterborne urethane alkyd, interior/exterior matching topcoat.
 - 3) Topcoat: Waterborne urethane alkyd, interior/exterior, eggshell, Dunn-Edwards, Aristoshield ASHL30, (Gloss Level 3).
Or
 - 4) Topcoat: Waterborne urethane alkyd, interior/exterior, low sheen, Dunn-Edwards, Aristoshield ASHL40, (Gloss Level 4).
Or
 - 5) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5)
 3. Non-Ferrous Metal Substrates:
 - a. Waterborne Urethane Alkyd Enamel over a Latex Primer System:
 - 1) Prime Coat: Primer, waterbased, interior/exterior, Dunn-Edwards Ultrashield Galvanized Metal Primer ULGM00.
 - 2) Intermediate Coat: Waterborne urethane alkyd, interior/exterior, matching topcoat.
 - 3) Topcoat: Waterborne urethane alkyd, interior/exterior, eggshell, Dunn-Edwards, Aristoshield ASHL30, (Gloss Level 3).
Or
 - 4) Topcoat: Waterborne urethane alkyd, interior/exterior, low sheen, Dunn-Edwards, Aristoshield ASHL40, (Gloss Level 4).
Or
 - 5) Topcoat: Waterborne urethane alkyd, interior/exterior, semi-gloss, Dunn-Edwards, Aristoshield ASHL50, (Gloss Level 5)

Cross-Over Chart			
Paint Type	Dunn-Edwards BOD	Kelly Moore	Sherwin Williams
100% Acrylic Eggshell Exterior Paint	EVSH30 Evershield 100% Acrylic	1294 Envy Exterior 100% Acrylic	KxxW000xx Series Emerald Exterior Acrylic Latex
100% Acrylic Low Sheen Exterior Paint	EVSH40 Evershield 100% Acrylic	1294 Envy Exterior 100% Acrylic	KxxW000xx Series Emerald Exterior Acrylic Latex
100% Acrylic Semi-Gloss Exterior Paint	EVSH50 Evershield 100% Acrylic	1298 Envy Exterior 100% Acrylic	KxxW000xx Series Emerald Exterior Acrylic Latex
Water-Borne Alkyd Urethane Eggshell Interior/Exterior Paint	ASHL30 Aristoshield Urethane Alkyd	1997 Epic Urethane Alkyd Enamel	KxxW0xxxx Series Emerald Urethane Trim Enamel
Water-Borne Alkyd Urethane Low Sheen Interior/Exterior Paint	ASHL40 Aristoshield Urethane Alkyd	1997 Epic Urethane Alkyd Enamel	KxxW0xxxx Series Emerald Urethane Trim Enamel
Water-Borne Alkyd Urethane Semi-Gloss Interior/Exterior Paint	ASHL50 Aristoshield Urethane Alkyd	1998 Epic Urethane Alkyd Enamel	KxxW0xxxx Series Emerald Urethane Trim Enamel

END OF SECTION

SECTION 10 90 00

MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Miscellaneous specialty items.
- B. Accessory anchors, bolts, screws, and braces.

1.02 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Shop Drawings:
 - 1. Indicate fabrication, materials, installation details, finishes, and any other required anchoring, fastenings, and hardware.
 - 2. Submit drawing layout for product configuration, support attachment and anchorage details.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 01.
- B. Store in manufacturer's original unopened containers and packaging. Protect and handle products to prevent damage to products or finishes.

PART 2 - PRODUCTS

2.01 PORTABLE BATTING CAGE

- A. Model No. CAG100 portable batting cage as manufactured by C&H Baseball or accepted equal, with the following characteristics:
 - 1. Non-folding cage.
 - 2. Heavy duty 2.375 inch diameter aluminum pipe.
 - 3. Inside Dimensions: 18 feet wide x 14 feet-6 inches deep x 10 feet high.
 - 4. Outside Dimensions: 21 feet wide x 17 feet deep x 10 feet-3 inches high.
 - 5. All-welded construction. Double welded pipe in high stress areas.
 - 6. #60 knotted nylon netting.
 - 7. Tires: Three Amerityre flat-less tires.
 - 8. Padding: Peoria Option.
 - 9. Ballstop: Unpadded.

2.02 SOFTBALL BATTING CAGE

- A. Model No. BTOSD ground sleeve double overhead softball batting tunnel as manufactured by Sportsfield Specialties, Inc. or accepted equal, with the following characteristics:

1. Framework: 4 inch outside diameter x 1/8 inch wall thickness black powder coated aluminum.
2. Ground Sleeve: 30 inches long.
3. Overall Length: 55 feet.
4. Bay Width: 18 feet – 4 inches.
5. Frame Height: 14 feet – 4-3/4 inches above finished grade.
6. Frame width: 17 feet – 1-1/2 inches
7. Netting: Model No. BSSN60 netting with the following characteristics:
 - a. Material: 1-3/4 inch #60 knotted nylon mesh.
 - b. Factory-sewn lead line bottom.
 - c. Color: Black.

2.03 DRINKING FOUNTAINS

- A. Model 3612F vandal-resistant pedestal drinking fountain with bottle filler as manufactured by Haws Corporation or accepted equal, with the following characteristics:
 1. Heavy duty stainless steel pedestal with custom color powder coat paint finish.
 2. Front approach ADA compliant bottle filling station and dual height high-low drinking fountain.
 3. Stainless steel drinking fountain bowls.
 4. Push-button activated valves with stainless steel valve body.
 5. Polished chrome plated brass shielded bubbler heads with integral 5/8 inch diameter threaded shank.
 6. Provide Model 3660 lockable hose bibb attachment.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All products in this Section shall be installed according to manufacturer's instructions and as detailed on Drawings.

3.02 ADJUST AND CLEAN

- A. Clean and Touch-up: Remove all packing and protection blemishes and thoroughly clean and polish all finish surfaces. Restore any marred or abraded surfaces to their original condition by touching up in accordance with the manufacturer's recommendations. Touch-up shall not be obvious.
- B. Defective work: Remove and replace all defective work which cannot be properly repaired, cleaned or touched up, as directed by Architect, with no additional cost to the Owner.
- C. Protect installed work during the construction period to prevent abuse and damage.

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The extent of work in this Section includes the provision and installation of the site furnishing equipment and structures with all miscellaneous hardware, foundations and appurtenances required for installation.
- B. The general extent of work for this Section is shown on the drawings and includes, but is not limited to, the following:
 - 1. 5-Row Bleacher.
 - 2. Baseball Pitcher's Rubber.
 - 3. Baseball Bases.
 - 4. Baseball/Softball Home Plate.
 - 5. Baseball/Softball Home Plate – synthetic turf.
 - 6. Helmet, Bat Bin and Side Storage Stand-up Cubby Unit.
 - 7. Flag Pole.
 - 8. Foul Pole Sets.
 - 9. Guard Rail System.
 - 10. Scorer's Table.
 - 11. Softball Bases.
 - 12. Softball Pitcher's Rubber.
 - 13. Two-Tier Team Benches.
 - 14. Softball Pitcher's Rubber – synthetic turf.
 - 15. Tennis Net.
 - 16. Tennis Post Set.
- C. Related Sections include the following:
 - 1. Specification section 32 13 13 "Site Concrete" for concrete footings and bases.

1.3 QUALITY ASSURANCE

- A. All manufactured items shall be inspected and approved upon delivery.
- B. Unless otherwise specified, install all materials in accordance with manufacturer’s recommendations.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for site furnishings conforming to requirements of Division 1, Section 01 33 00 Submittal Procedures.
- B. Product Warranty, spare or replacement parts, and/or care instructions shipped with components shall be delivered to Owner prior to substantial completion.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Store and handle products so as not to impede work of others.
- B. Protect products from damage or theft during delivery, handling, storage and installation.
- C. Contractor shall schedule delivery and receive site furnishings contained within this Specification whether purchased as part of this project or purchased by Owner as part of this project. This shall include unloading site furnishings, taking inventory and accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS

ITEM	DESCRIPTION	MANUFACTURER	MODEL #	FINSH/COLOR	LOCAL REP
1	5-Row Bleacher	Southern Bleacher Co.	Custom	Custom	
2	Baseball Pitcher’s Rubber	Schutt Hollywood	SHBBPB	Molded Rubber	Sportsfield Specialties
	Baseball Pitcher’s Rubber – synthetic turf	Sportsfield Specialties	TBPR - TurfBase		Sportsfield Specialties
3	Baseball Bases	Schutt Hollywood	Impact Bases (set of 3)	w/ matching ground anchor mounts and base plugs for each	Sportsfield Specialties
4	Baseball/Softball Home Plate	Schutt Hollywood	SHP-UM	MLB Universal Pro Style Home Plate	Sportsfield Specialties
5	Baseball/Softball Home Plate – synthetic turf	Sportsfield Specialties	TBHP	TurfBase Home Plate	Sportsfield Specialties

6	Helmet, Bat Bin and Side Storage Stand-up Cubby Unit.	Sportsfield Specialties	SUAHC12BBSS	Color to be selected by Owner's Representative	Sportsfield Specialties
8	Flag Pole	Concord American Flagpole	IRW25D61		Concord American Flagpole (800) 527-3902
9	Foul Pole Sets	Sportsfield Specialties	FPW420	20' tall, std yellow finish	Sportsfield Specialties
10	Guard Rail System	Sportsfield Specialties	GRS42, 42' L section	Custom size, school colors to be selected by Owner's Representative	Sportsfield Specialties
11	Scorer's Table	Sportsfield Specialties	ST58 Galvanized finish	Provide in school colors of dark blue with custom panel to read "McClatchy High School"	Sportsfield Specialties
12	Softball Bases	Schutt Hollywood	Impact Bases (set of 3)	w/ matching ground anchor mounts and base plugs for each	Sportsfield Specialties
13	Softball Pitcher's Rubber	Sportsfield Specialties	TBPR		Sportsfield Specialties
14	Two-Tier Team Benches – Player's Bench	Sportsfield Specialties	PTBTT8	8' length, clear anodized finish	Sportsfield Specialties
15	Softball Pitcher's Rubber – synthetic turf	Sportsfield Specialties	TBPR - TurfBase		Sportsfield Specialties
16	Tennis Net	Patterson-Williams	8352	Premium Tennis Net	Patterson-Williams (800) 687-5768
17	Tennis Post Set	Patterson-Williams	2201-11P	Color to be black	Patterson-Williams (800) 687-5768

Contractor shall purchase touch-up paint for each color of powder coated products for use as needed after installation. Deliver un-used touch-up paint to Owner prior to substantial completion
Contractor shall deliver dig-out tool to District Representative at substantial completion.

Local Representatives websites:

Beacon Athletics www.beaconathletics.com

BSN Sports www.bsnsports.com

Concord American Flagpole www.concordamericanflagpole.com

Manufacturer websites:

Dumor www.dumor.com

Patterson-Williams Athletic www.pwathletic.com

Sports Field Specialties www.sportsfield.com

PART 3 - EXECUTION

3.1 SEQUENCING AND SCHEDULING:

- A. Coordinate construction timing with installation of site furnishings in conformance with other pertinent Sections of the Specifications.

3.2 INSTALLATION

- A. Site Furnishings: Install where shown on drawings, as detailed and per manufacturer instructions. All site furnishings shall be secured in a vandal resistant manner acceptable to the Architect.
- B. Sports Equipment: Install where shown on drawings, as detailed and per manufacturer instructions.
- C. Concrete Footings: Install footings with top of concrete sloped to drain at 1%. Install where shown on drawings and as detailed and per manufacturer's instructions.
- D. Sleeves: Install site furnishings, standards and posts into sleeves embedded into concrete bases for removal and replacement where indicated or detailed on drawings.

END OF SECTION

SECTION 26 00 10

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Table of Contents, Division 26 - Electrical:

<u>SECTION NO.</u>	<u>SECTION TITLE</u>
260010	BASIC ELECTRICAL REQUIREMENTS
260090	ELECTRICAL DEMOLITION
260519	BUILDING WIRE AND CABLE
260526	GROUNDING AND BONDING
260531	CONDUIT
260533	BOXES
260543	UNDERGROUND DUCTS AND STRUCTURES
260553	ELECTRICAL IDENTIFICATION
262213	DRY TYPE TRANSFORMERS
262416	PANELBOARDS
262726	WIRING DEVICES
262816	OVERCURRENT PROTECTIVE DEVICES
265000	LIGHTING

B. Work included: This Section includes general administrative and procedural requirements for Division 26. The following administrative and procedural requirements are included in this Section to supplement the requirements specified in Division 01.

1. Quality assurance.
2. Definition of terms.
3. Submittals.
4. Coordination.
5. Record documents.
6. Operation and maintenance manuals.
7. Project management and coordination services.
8. Contract modification pricing procedures.
9. Excavation.
10. Rough-in.
11. Electrical installation.
12. Cutting, patching, painting, and sealing.
13. Field quality control.

14. Cleaning.
 15. Project closeout.
 16. Interface/Responsibility Matrix.
- C. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete and operable installation.
1. General and supplementary conditions: Drawings and general provisions of Contract and Division 01 of the Specifications, apply to all Division 26 Sections.
 2. Earthwork: Include trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, in-grade pull boxes, vaults, lighting pole foundations, etc. Refer to Division 31, Earthwork.
 3. Selective demolition: Nondestructive removal of materials and equipment for reuse or salvage as indicated. Also dismantling electrical materials and equipment made obsolete by these installations. Refer to Division 02, Selective Demolition.
 4. Concrete work: Include forming, steel bar reinforcing, cast-in- place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, housekeeping pads, etc. Also includes setting of floor boxes in existing concrete slabs, saw-cutting of existing slabs and grouting of conduits in saw-cut. Refer to Division 03, Concrete.
 5. Miscellaneous metal work: Include fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, luminaires, panelboards, distribution boards, switchboards, motor control centers, etc. Refer to Division 05, Miscellaneous Metals.
 6. Miscellaneous lumber and framing work: Include wood grounds, nailers, blocking, fasteners and anchorage for support of electrical materials and equipment. Refer to Division 06, Rough Carpentry.
 7. Painting: Include surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, etc. where indicated as field painted in this Division. Refer to Division 09, Painting.
- D. Work furnished and installed under another Division requiring connections under this Division includes but is not limited to:
1. Electric motors.
 2. Irrigation controller(s). (Line voltage only)

1.02 QUALITY ASSURANCE

- A. Reference to Codes, Standards, Specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.
- B. When codes, standards, regulations, etc. allow Work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred authority

for reducing the quality, requirements, or extent of the Contract Documents. The Contract Documents address the minimum requirements for construction.

- C. Work shall be performed in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
1. California Electric Code (CEC).
 2. California Building Code (CBC).
 3. California Fire Code (CFC).
 4. California Mechanical Code (CMC).
- D. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:
- | | |
|-------|---|
| ACI | American Concrete Institute |
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing Materials |
| CBM | Certified Ballast Manufacturers |
| ETL | Electrical Testing Laboratories |
| FS | Federal Specification |
| IEEE | Institute of Electrical and Electronics Engineers, Inc. |
| IPCEA | Insulated Power Cable Engineer Association |
| NEMA | National Electrical Manufacturer's Association |
| UL | Underwriters' Laboratories |
- E. Independent Testing Agency qualifications:
1. Testing Agency shall be an independent testing organization that will function as an unbiased authority, professionally independent of Manufacturer, Supplier and Contractor, furnishing and installing equipment or system evaluated by Testing Agency.
 2. Testing Agency shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.
 3. Testing Agency shall meet Federal Occupational Safety and Health Administration (OSHA) requirements for accreditation of independent testing laboratories, Title 9, Part 1907.
 4. On-site technical personnel shall be currently certified by the International Electrical Testing Association in electrical power distribution system testing.
 5. Testing Agency shall use technicians who are regularly employed by the firm for testing services.
 6. Contractor shall submit proof of above Testing Agency qualifications with bid documentation upon request.
- F. All base material shall be ASTM and/or ANSI standards.
- G. All electrical apparatus furnished under this Section shall conform to NEMA standards and the CEC and bear the UL label where such label is applicable.

- H. Certify that each welder performing Work has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.03 DEFINITION OF TERMS

- A. The following list of terms as used in the Division 26 documents shall be defined as follows:
 - 1. "Provide": Shall mean furnish, install, and connect unless otherwise indicated.
 - 2. "Furnish": Shall mean purchase and deliver to Project site.
 - 3. "Install": Shall mean to physically install the items in-place.
 - 4. "Connect": Shall mean make final electrical connections for a complete operating piece of equipment.
 - 5. "As directed": Shall be as directed by the Owner or their authorized Representative.
 - 6. "Utility Companies": Shall mean the company providing electrical, telephone or cable television services to the Project.

1.04 SUBMITTALS

- A. Format: Furnish submittal data in electronic format for each Specification Section with a table of contents listing materials by Section and paragraph number.
- B. Submittals shall consist of detailed Shop Drawings, Specifications, block wiring diagrams, "catalog cuts" and data sheets containing physical and dimensional information, performance data, electrical characteristics, materials used in fabrication and material finish. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories which are included and those which are excluded. Furnish quantities of each submittal as noted in Division 01.
- C. Each submittal shall be labeled with the Specification Section Number and shall be accompanied by a cover letter or shall bear a stamp stating that the submittal has been thoroughly reviewed by the Contractor and is in full compliance with the requirements of the Contract Documents or provide a Specification Section line-by-line compliance response statement with detailed exception/ deviation response statements for all applicable provisions for the applicable Specification Section. Any Specification Section lines without a detailed exception/ deviation response statement shall be treated as the Contractor or Vendor is submitting in full compliance with the applicable Specification Section requirements. Cover letters shall list in full the items and data submitted. Failure to comply with this requirement shall constitute grounds for rejection of data.
- D. The Contractor shall submit detailed Drawings of all electrical equipment rooms and closets if the proposed installation layout differs from the construction documents. Physical size of electrical equipment indicated on the Drawings shall match those of the electrical equipment that is being submitted for review, i.e.: switchboards, panelboards, transformers, control panels, etc. Minimum scale: 1/4" = 1'- 0". Revised electrical equipment layouts must be approved prior to release of order for equipment and prior to installation.
- E. As part of the equipment and fixture submittals, the Contractor shall provide anchorage calculations for floor and wall mounted electrical equipment and fixtures, distribution conduits and raceways, in conformance with the 2022 California Building Code (CBC) and ASCE 7-16. Use the Occupancy Category, Ground Accelerations, Site Class, Seismic Design

- Category, and Seismic Importance Factor as noted in the structural drawings. For components required for Life Safety or containing hazardous materials use $I_p=1.5$. Structural Calculations shall be prepared, stamped, and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used.
- F. The Manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the Contractor with the assembly dimensions, weights, and approximate centers of gravity.
 - G. Review of submittals is for general conformance to design concept and general compliance with the Specification Sections. Submittal Review Comments do not imply waiver of Specifications Section requirements unless specifically noted.
 - H. All resubmittals shall include a cover letter that lists the action taken and revisions made to each Drawing and equipment data sheet in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.
 - I. Shop Drawings for the following systems must be prepared via a computer aided drafting (CAD)building information modeling (Revit) system for submission by the Contractor. The Engineer can provide CADRevit files of the electrical Contract Documents to the Contractor.
 - 1. Manufactured wiring system, Section 260519.
 - 2. Fire alarm system, Section 266113.
 - 3. Security system, Section 266513.
 - 4. Telecommunication cabling system, Section 267113.
 - J. Independent Testing Agency report:
 - 1. Testing Agency shall provide 3 copies of the complete testing report.
 - 2. Test report shall include the following:
 - a. Summary of Project.
 - b. Description of equipment.
 - c. Equipment used to conduct the test.
 - 1) Type.
 - 2) Manufacturer.
 - 3) Model number.
 - 4) Serial number.
 - 5) Date of last calibration.
 - 6) Documentation of calibration leading to NIST standards.
 - d. Description of test.
 - e. Test results, as compared to Manufacturers or industry accepted standards and tolerances.
 - f. Conclusion and recommendation.

- g. Signature of responsible test organization authority.
 - 3. Furnish completed test report to Engineer no later than 30-days after completion of testing, unless otherwise directed.
- K. Substitutions:
- 1. All requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
 - 2. Where items are noted as "or equal," a product of equal design, construction and performance will be considered. Contractor must submit to the Engineer all pertinent test data, catalog cuts and product information required substantiating that the product is in fact equal to that specified. Only one substitution will be considered for each product specified.
 - 3. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility, and appearance. Materials, processes, or equipment, which in the opinion of the Engineer is equal in quality, utility, and appearance, will be approved as substitutions to that specified.
 - 4. Whenever any material, process or equipment is specified in accordance with a Federal specification, an ASTM standard, an ANSI specification, UL rating or other association standard, the Contractor shall present an affidavit from the Manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, support test data to substantiate compliance shall be submitted by the Contractor at no additional cost.
 - 5. Substitutions shall be equal, in the opinion of the Architect/Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Architect/Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted article or material to be equal to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the Work or from any provisions of the Specifications.
 - 6. The Contractor shall be responsible for all expenses in connection with the substitution materials, processes, and equipment, including the effect of the substitution on the Contractor, Subcontractor's, or other Contractor's Work. No substitution of material, processes or equipment shall be permitted without written authorization of the Architect/Engineer. Any assumptions on the acceptability of a proposed substitution prior to acceptance by the Engineer are at the sole risk of the Contractor.

1.05 COORDINATION

- A. Discrepancies:
- 1. In the event of discrepancies within the Contract Documents, the Engineer shall be so notified, within sufficient time, as delineated in Division 01, prior to the Bid Opening to allow the issuance of an Addendum.
 - 2. If, in the event that time does not permit notification or clarification of discrepancies prior to the Bid Opening, the following shall apply: The Drawings govern in matters of

quantity and the Specifications govern in matters of quality. In the event of conflict within the Drawings involving quantities or within the Specifications involving quantities or within the Specifications involving quality, the greater quantity and higher quality shall apply. Such discrepancies shall be noted and clarified in the Contractor's Bid. No additional allowances will be made because of errors, ambiguities or omissions that reasonably should have been discovered during the preparation of the Bid.

B. Project conditions:

1. Examination of Project site: The Contractor shall visit the Project site and thoroughly review the locale, working conditions, conflicting utilities, and the conditions in which the Electrical Work will take place. Verify all existing conditions in the field. No allowances will be made subsequently for any costs that may be incurred because of any error or omission due to failure to examine the Project site and to notify the Engineer of any discrepancies between Contract Documents and actual Project site conditions.
2. Protection: Keep conduits, junction boxes, outlet boxes and other openings closed to prevent entry of foreign matter. Cover fixtures, equipment, devices, and apparatus and protect them against dirt, paint, water, chemical or mechanical damage, before and during construction period. Prior to final acceptance, restore to original condition any fixture, apparatus or equipment damaged including restoration of damaged factory applied painted finishes. Protect bright finished surfaces and similar items until in service. No rust or damage will be permitted.
3. Supervision: Contractor shall personally or through an authorized and competent representative constantly supervise the Work from beginning to completion and, within reason, keep the same foreman and workmen on the Project throughout the Project duration.

C. Preparation:

1. Drawings:
 - a. Layout: General layout indicated on the Drawings shall be followed except where other Work may conflict with the Drawings.
 - b. Accuracy: Drawings for the Work under this Section are essentially diagrammatic within the constraints of the symbology applied.

1.06 RECORD DOCUMENTS

A. Provide Project Record Drawings as described herein:

1. Drawings shall fully represent installed conditions including actual locations of outlets, true panelboard connections following phase balancing routines, correct conduit, and wire sizing as well as routing, revised luminaire schedule listing Manufacturers and products installed and revised panel schedules. Contractor shall record all changes in the Work during the course of construction on blue or black line prints. These prints shall be made subject of monthly review by the Owner's Representative to ascertain that they are current. If not current, monthly payments may be withheld.
2. Record Drawings shall be the transfer of information on these prints to the construction documents via computer aided drafting (CAD)building information modeling (Revit) process. A set of Revit files of the electrical construction documents will be provided to

the Contractor by the Engineer. For the BIM/clash detection process, a Revit file of the electrical construction documents will be provided to the Contractor by the Engineer, which will represent a LOD of 300 design level. The Contractor is responsible for updating the model with changes as well as taking the model to a LOD of 500 design level.

3. Record drawing submissions shall be provided to the Engineer to review upon the completion of the following phases of Work:
 - a. Final electrical installation.
 4. Include in the record drawing submission the following shop drawing submission with all updated installation information:
 - a. Telecommunication cabling system
 5. A single set of half size prints of the Record Drawings shall be submitted for review. Upon receipt of the Engineer's review comments, corrections shall be made, and the Contractor shall provide the following:
 - a. One set of full-size prints.
 - b. Electronic files of Drawings in PDF.
- B. Panel schedules:
1. Typewritten panel schedules shall be provided for panelboards indicating the loads served and the correct branch circuit number. Schedules shall be prepared on forms provided by the Manufacturer and inserted in the pocket of the inner door of each panelboard. See Section 262416: Panelboards for requirements.
- C. Field labels, markings, and warning signs: Provide in accordance and as required by:
1. General: CEC Article 110.21.
 2. Arc-Flash Warning: CEC Article 110.16.
 3. Identification of Disconnecting Means: CEC Article 110.22 (A).

1.07 OPERATION AND MAINTENANCE MANUALS

- A. Prior to Project closeout furnish to the Owner, six (6) hard back 3-ring binders containing all bulletins, operation and maintenance instructions, part lists, service telephone numbers and other pertinent information as noted in each Section all equipment furnished under Division 26. Binders shall be indexed into Division Sections and labeled for easy reference. Bulletins containing more information than the equipment concerned shall be properly stripped and assembled.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. All work shall be installed in a neat, workmanlike manner in accordance with ANSI/NECA 1-2015.
- B. Comply with the requirements of all listed codes and standards.

- C. All materials and equipment provided under this contract shall be new (except where otherwise noted) and shall be listed, labeled or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL.
- D. All equipment of the same type and capacity shall be by the same manufacturer.
- E. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.
- F. During construction the contractor shall at all times maintain electrical utilities of the building without interruption. Should it be necessary to interrupt any electrical service or utility, the contractor shall secure permission in writing from the owner's representative for such Interruption at least ten (10) business days in advance. Any interruption shall be made with minimum amount of inconvenience and any shut-down time shall have to be on a premium time basis and such time to be included in the contractor's bid. Arrange to provide and pay for temporary power source as required by project conditions.
- G. Working clearance around equipment shall not be less than that specified in the CEC for all voltages specified.
- H. The locations of switches, receptacles, lights, motors, etc. outlets shown are approximate. The contractor shall use good judgment in placing the preceding items to eliminate all interference with ducts, piping, etc. The contractor shall check all door swings so that light switches are not located behind doors. Relocate switches as required, with approval from the Design Professional. The owner's representative may direct relocation of outlets before installation, up to five (5) feet from the position indicated on the Drawings, without additional cost.
- I. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Normal maintenance shall not require the removal of protective guards from adjacent equipment. Install equipment as close as practical to the locations shown on the Drawings.
 - 1. Where the owner's representative determines that the Contractor has installed equipment not conveniently accessible for operations and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the owner.
 - 2. "Conveniently Accessible" is defined as being capable of being reached without climbing or crawling over or under obstacles such as motors, pumps, belt guards, transformers, racks, piping, ductwork, raceways or similar.
- J. Owner furnished equipment: Equipment furnished by the District shall be received, stored, uncrated, protected, and installed by the Contractor with all appurtenances required to place the equipment in operation, ready for use. The Contractor shall be responsible for the equipment as if he had purchased the equipment himself and shall hold the warranty

3.02 ROUGH-IN

- A. Contractor shall verify lines, levels and dimensions indicated on the Drawings and shall be responsible for the accuracy of the setting out of Work and for its strict conformance with existing conditions at the Project site.
- B. Verify final locations for rough ins with field measurements and with the requirements for the actual equipment to be connected.

3.03 ELECTRICAL INSTALLATION

- A. Preparation, sequencing, handling, and installation shall be in accordance with Manufacturer's written instructions and technical data particular to the product specified and/or accepted equal except as otherwise specified. Comply with the following requirements:
 - 1. Shop Drawings prepared by Manufacturer.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate and integrate installations of electrical materials and equipment for efficient flow of the Work. Give attention to large equipment requiring positioning prior to closing in the building.
 - 6. Where mounting height is not detailed or dimensioned, contact the Architect for direction prior to proceeding with rough-in.
 - 7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
 - 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination Drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are indicated only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 - 9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components, where installed exposed in finished spaces.
 - 10. Install electrical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
 - 11. Coordinate electrical systems, equipment, and materials installations with other building components.
 - 12. Install systems, materials and equipment giving right-of-way priority to other systems that are required to maintain a specified slope.

13. Conform to the National Electrical Contractors Association "Standard of Installation" for general installation practice.

3.04 CUTTING, PATCHING, PAINTING AND SEALING

- A. Structural members shall in no case be drilled, bored, or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the Architect and Structural Engineer.
- B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- C. Cut, remove, and legally dispose of selected electrical equipment, components and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.
- D. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- F. Patch existing surfaces and building components using experienced installers and new materials matching existing materials and the original installation. For installers' qualifications refer to the materials and methods required for the surface and building components being patched.
- G. Application of joint sealers:
 1. General: Comply with joint sealer Manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 2. Installation of fire-stopping sealant: Install sealant, including forming, packing and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire-stops and fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.05 FIELD QUALITY CONTROL

- A. General testing requirements:
 1. The purpose of testing is to ensure that all tested electrical equipment, both Contractor and Owner supplied, is operational and within industry and Manufacturer's tolerances and is installed in accordance with design Specifications.
 2. Tests and inspections shall determine suitability for energization.
 3. Perform tests in presence of the Owner's Representative and furnish test equipment, facilities and technical personnel required to perform tests.
 4. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.
- B. Tests: In addition to specific system test described elsewhere, tests shall include:

1. Equipment operations: Test motors for correct operation and rotation.
 2. Lighting control circuits: Test lighting circuits for correct operation through their control devices.
 3. Alarm and interlock systems: Produce malfunction symptoms in operating systems to test alarm and interlock systems. In addition, all specific tests described in the fire alarm system shall be performed.
 4. Circuit numbering verification: Select on a random basis, various circuit breakers within the panelboards and cycle them on and off to verify compliance of the typed panel directories with actual field wiring.
 5. Voltage check:
 - a. At completion of job, check voltage at several points of utilization on the system that has been installed under this Contract. During test, energize all installed loads.
 - b. Adjust taps on transformers to give proper voltage, which is 118 to 122volts for 120volt nominal systems and proportionately equivalent for higher voltage systems. If proper voltage cannot be obtained, inform the Owner and the serving Utility Company.
- C. Contractor shall provide test power required when testing equipment before service energization and coordinate availability of test power with General Contractor after service energization. The Contractor shall provide any specialized test power as needed or specified herein.
- D. Testing safety and precautions:
1. Safety practices shall include the following requirements:
 - a. Applicable State and Local safety operating procedures.
 - b. OSHA.
 - c. NSC.
 - d. NFPA 70E.
 2. All tests shall be performed with apparatus de-energized and grounded except where otherwise specifically required ungrounded by test procedure.
- E. Calibration of test equipment:
1. Testing Agency shall have calibration program that assures test instruments are maintained within rated accuracy.
 2. Instruments shall be calibrated in accordance with the following frequency schedule:
 - a. Field instruments: Analog, 6-months maximum; Digital, 12-months maximum.
 - b. Laboratory instruments: 12-months.
 - c. Leased specialty equipment: 12-months where accuracy is guaranteed by lessor.
 3. Dated calibration labels shall be visible on test equipment.

4. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
 5. Up-to-date instrument calibration instructions and procedures shall be maintained for test instrument.
 6. Calibration standards shall be of higher accuracy than instrument tested.
 7. Equipment used for field testing shall be more accurate than instrument being tested.
- F. Coordinate with General Contractor regarding testing schedule and availability of equipment ready for testing.
- G. Notify Owner and Engineer one week in advance of any testing.
- H. Any products which fail during the tests or are ruled unsatisfactory by the Owner's Representative shall be replaced, repaired, or corrected as prescribed by the Owner's Representative at the expense of the Contractor. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.
- I. Testing Agency shall maintain written record of tests and shall assemble and certify final test report.
- J. Include all test results in the maintenance manuals.

3.06 CLEANING

- A. Prior to energizing of electrical equipment, the Contractor shall thoroughly clean the interior of enclosures from construction debris, scrap wire, etc. using Manufacturer's approved methods and materials.
- B. Upon completion of Project, prior to final acceptance, the Contractor shall thoroughly clean both the interior and exterior of all electrical equipment per Manufacturers approved methods and materials. Remove paint splatters and other spots, dirt, and debris.
- C. Touch-up paint any marks, blemishes or other finish damage suffered during installation.

3.07 PROJECT CLOSEOUT

- A. Training:
1. At the time of completion, a period of not less than 4-hours shall be allotted by the Contractor for instruction of building operating and maintenance personnel in the use of all systems. This 4-hour training is in addition to any instruction time called out in the Specifications for specific systems. All personnel shall be instructed at one time, the Contractor making all necessary arrangements with Manufacturer's Representative. The equipment Manufacturer shall be requested to provide product literature and application guides for the users' reference. Costs, if any, for the above services shall be paid by the Contractor.
 2. All training sessions shall be video recorded. Confirm file type, i.e. MOV, AVI, MP4, etc. with the district. Each specification section that requires training shall include one file, and all Division 26 specifications shall be stored on a flash drive (USB3.0, 1TB min.) 3 flash drives shall be provided to the district representative with closeout documentation.

- B. Special tools: Provide one of each tool type required for proper operation and maintenance of the equipment provided under this Section. All tools shall be delivered to the Owner at the Project completion.
- C. Keying: Provide two keys for each lock furnished under this Section and turn over to Owner.

END OF SECTION

SECTION 26 00 90
ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor and equipment necessary to complete the demolition required for the item specified under this Division, including but not limited to:
 - 1. Electrical demolition

1.02 SYSTEM DESCRIPTION

- A. Disconnection, removal and relocation of all wiring, luminaires, outlets, conduit, and all other types of electrical equipment as described on Drawings.
- B. Purpose is to remove, relocate and extend existing installations to accommodate new construction.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment necessary for patching and extending Work, as specified in other Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly review conditions in the area of demolition prior to commencing Work to ensure complete understanding of existing installation in relationship to demolition Work.

3.02 GENERAL REQUIREMENTS

- A. Remove all wiring, outlets, conduit, and electrical equipment indicated to be removed. Devices that are to be removed may require reworking conduit and wiring in order to maintain service to other devices. If removed devices are on walls or ceilings that are to remain, blank coverplates are to be installed on outlet boxes.
- B. Where remodeling interferes with circuits in areas that are otherwise undisturbed, circuits shall be reworked as required.
- C. Existing devices and circuiting that are indicated are indicated only for informational purposes. Contractor shall visit the Project site and shall verify conditions as they exist and shall remove, relocate, and/or rework any electrical equipment or circuits affected (whether indicated or not) due to removal of existing walls, ceilings, etc. Coordinate all Work with that of other trades.
- D. All equipment, luminaires, devices, etc., which are removed shall be delivered to the Owner for disposition. All items which are removed and not wanted by the Owner and which are

not reused shall become the property of the Contractor and shall be legally removed from the Project site.

- E. Cutting and patching necessary for the removal of Electrical Work shall be included.
- F. Remove and replace luminaires, rework, relocate or replace conduit and wiring and do other Work required by the installation of new ductwork, piping, etc., above the ceiling. Coordinate with other trades and verify the extent of the Work.

3.03 CONDUIT

- A. Remove abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

3.04 WIRING

- A. Remove abandoned wiring to source of supply.

3.05 EXISTING SYSTEMS

- A. Electrical distribution system: Disable system only to make switchovers and connections. Obtain permission from Owner's designated representative at least 24-hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to Work area.

3.06 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that shall remain.

END OF SECTION

SECTION 26 05 19

BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Building wire.
 - 2. Cable.
 - 3. Wiring connections and terminations.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 44; Thermoset-Insulated Wires and Cables.
 - UL 62; Flexible Cord and Fixture Wire.
 - UL 83; Thermoplastic-Insulated Wires and Cables.
 - UL 486A & B; Wire Connectors.
 - UL 486C; Splicing Wire Connectors.
 - UL 486D; Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
 - UL 493; Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.
 - UL 510; Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - UL 1581; Reference Standard for Electrical Wires, Cables and Flexible Cords.
 - 2. National Electrical Manufacturer Association (NEMA):
 - NEMA WC-70; Power Cables Rated 2,000 V or Less for the Distribution of Electrical Energy.
 - 3. Institute of Electrical and Electronic Engineers (IEEE):
 - IEEE 82; Test Procedure for Impulse Voltage Tests on Insulated Conductors.

IEEE 576; Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.
 - 4. Final test results.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.
- C. Independent Testing Agency qualifications: Refer to Section 260010: Basic Electrical Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Building wire:
 - a. Cerrowire
 - b. General Cable
 - c. Southwire Company
 - d. United Wire and Cable
 - 2. Wiring connectors and terminations:
 - a. 3M Company.
 - b. Ideal.
 - c. Blackburn-Holub.
 - d. Burndy.
 - e. Thomas & Betts Corp.
 - f. Beau Barrier.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 BUILDING WIRE

A. Conductor material:

1. Provide annealed copper for all wire, conductor, and cable, unless otherwise indicated.
2. All building wire shall be stranded, unless otherwise indicated.

B. Insulation material:

1. All insulated wire, conductor and cable shall be 600volt rated, unless otherwise noted on the Drawings.
2. Thermoplastic-insulated building wire.
3. Rubber-insulated building wire.
4. Copper feeders and branch circuits larger than #6 AWG: Type THW, XHHW or dual rated THHN/THWN.
5. Copper feeders and branch circuits #6 AWG and smaller: Type TW, THW, XHHW or dual rated THHN/THWN.
6. Service Entrance: Type RHW or THWN.
7. Control Circuits: Type THW or dual rated THHN/THWN.
8. Identify system conductors as to voltage and phase connections by means of color-impregnated insulation.

2.03 WIRING CONNECTIONS AND TERMINATIONS

A. Bolted pressure connectors: Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

B. Electrical spring wire connectors:

1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-section steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.
2. Self-striping pigtail and tap U-contact connectors shall not be used.

C. Compression type terminating lugs:

1. Provide tin-plated copper high-compression type lugs for installation with hand or hydraulically operated circumference-crimping tools and dies as stipulated by the lug Manufacturer or as indicated on Drawings. Notch or single point type crimping is NOT acceptable.
2. Two-hole, long barrel lugs shall be provided for size #4/0 and larger wire where terminated to bus bars. Use minimum of three crimps per lug, on sizes where possible.

D. Splicing and insulating tape: Provide black, ultraviolet proof, self-extinguishing, 7-mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000volts suitable for temperatures from minus 18-degrees C to 105-degrees C.

E. Insulating putty:

1. Provide pads or rolls of non-corrosive, self-fusing, one-eighth inch thick rubber putty with PVC backing sheet. Scotch vinyl mastic pads and roll or equal.
 2. Use putty suitable for temperatures from minus 17.8-degrees C to 37.8-degrees C with a dielectric strength of 570volts/mil minimum.
- F. Insulating resin:
1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. Scotchcast 4 or equal for wet or underground vaults, boxes, etc. splices or terminations.
 2. Use resin with a set up time of approximately 30-minutes at 21.1-degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.
- G. Terminal strips:
1. Provide box type terminal strips in the required quantity plus 25% spare. Install in continuous rows in terminal cabinets.
 2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
 3. Identify all terminals with numbering sequence being used for a system.
- H. Crimp type connectors:
1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support
 2. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector Manufacturer.
 3. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support.
 4. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support.
- I. Cable ties: Provide harnessing and point-to-point wire bundling with nylon cable ties. All cable ties shall be installed using tool supplied by Manufacturer of ties.
- J. Wire lubricating compound:
1. UL listed for the wire insulation and conduit type and shall not harden or become adhesive.
 2. Shall not be used on wire for isolated type electrical power systems.
- K. Bolt termination hardware:
1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE grade 5; or silicon bronze alloy ASTM B-9954 Type B.
 2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.

3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, confirming to ANSI B27.2. SAE or narrow series shall not be used.
4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
 - a. 1/4" bolt: 125amps
 - b. 5/16" bolt: 175amps
 - c. 3/8" bolt: 225amps
 - d. 1/2" bolt: 300amps
 - e. 5/8" bolt: 375amps
 - f. 3/4" bolt: 450amps

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of wire and cable installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

- A. All wire, conductor and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient condition.
- B. Feeders and branch circuits in wet locations shall be rated 75-degree C.
- C. Feeders and branch circuits in dry locations shall be rated 90-degree C.
- D. Feeders and branch circuits for direct-current (DC) systems, such as PV installations, in wet locations shall be type XHHW-2 copper conductors.
- E. Minimum conductor size:
 1. Provide minimum AWG #12 for all power and lighting branch circuits.
 2. Provide minimum AWG #14 for all line voltage signal and control wiring unless otherwise indicated.
- F. Color coding:
 1. For 120/208volt, 3-phase, 4-wire systems:
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 - e. Ground - Green

2. For 277/480volt, 3-phase, 4-wire systems:
 - a. Phase A - Brown
 - b. Phase B - Orange
 - c. Phase C - Yellow
 - d. Neutral - Gray
 - e. Ground - Green
3. Switch leg individually installed shall be the same color as the branch circuit to which they are connected, unless otherwise noted.
4. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.03 WIRING METHODS

- A. Install wires and cables in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Install all single conductors in raceway system, unless otherwise noted.
- C. Parallel circuit conductors and terminations shall be equal in length and identical in all ways.
- D. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.
- E. 20amp power and lighting branch circuit containing no more than four (4) current carrying conductors (phases and neutrals). Use #10 AWG conductor for 120/208volt circuits located outside a 75-foot radius of panel source and for 277/480volt branch circuits located outside a 200-foot radius of panel source, unless otherwise noted.
- F. 20amp power and lighting branch circuits containing no more than eight (8) current carrying conductors (phases and neutrals). Use #10 AWG conductors for 120/208volt circuits located outside a 65-foot radius of panel source and for 277/480volt circuits located outside a 150-foot radius of panel source.
- G. Provide #10 AWG pig tails on all 20amp and 30amp wiring devices served by #8 AWG conductors and larger.
- H. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes or handholes. Group and bundle with tie wrap each neutral with its associated phase conductor where more than one neutral is present in a conduit.
- I. Install cable supports for all vertical feeders in accordance with the CEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.
- J. Neatly form, train, and tie the cables in individual circuits. For panelboards, cabinets, wireways, switches, and equipment assemblies.

- K. Seal cable or wire, entering a building from underground or exiting walk-in cold box or freezer, between the wire or cable and conduit, where it exits the conduit, with a non-hardening approved compound, i.e. duct seal or equal.
- L. Provide UL-listed factory-fabricated, solderless metal connectors of size, ampacity rating, material, type, and class for applications and for services indicated. Use connectors with temperature ratings equal to or greater than the wires that are being terminated.
- M. Stranded wire shall be terminated using fitting, lugs or devices listed for the application. However, in no case shall stranded wire be terminated solely by wrapping it around a screw or bolt.
- N. Flexible cords and cables supplied, as part of a pre-manufacturer fixture or unit assembly shall be installed according to Manufacturers published installation instructions.

3.04 WIRING INSTALLATION IN RACEWAYS

- A. Install wire in raceway in accordance with IEEE 576, Manufacturer's written instructions, as indicated on the Drawings and as specified herein after interior of building has been physically protected from the weather and all mechanical Work likely to injure conductors has been completed. Pull all conductors into a raceway at the same time. Exercise care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.
- B. Completely mandrel all underground or concrete encased conduits prior to installing conductors.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors of size smaller than #1 AWG.
- E. Wire pulling:
 - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
 - 2. Use rope made of nonmetallic material for pulling feeders.
 - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
 - 4. Pull in together multiple conductors or cables in a single conduit.
 - 5. Pulling tensions and sidewall pressures shall not exceed 60% of the manufacturer's recommended maximum values. Pulling tension shall be continuously monitored during the pull by a calibrated dynamometer. If pulling tension is exceeded during the pull, immediately notify the engineer to determine if the cables will be considered damaged and require contractor replacement.
- F. Install and test all cables in accordance with Manufacturer's instructions and warranty.

3.05 WIRE SPLICES, JOINTS AND TERMINATION

- A. Join and terminate wire, conductors, and cables in accordance with UL 486A, C, CEC and Manufacturer's instructions.

- B. Thoroughly clean wires before installing lugs and connectors.
- C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- D. Splices and terminations shall be made mechanically and electrically secure.
- E. Where it's determined that unsatisfactory splice or terminations have been installed, remove the devices and install approved devices at no addition cost.
- F. Terminate wires in Terminal Cabinets, relay, and contactor panels, etc. using terminal strip connectors.
- G. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere in the panel or cabinet.
- H. Install cable ties and maintain harnessing.
- I. Encapsulate splices in exterior outlets, pull boxes and junction boxes using specified insulating resin kits. Make all splices watertight for exterior equipment and equipment in pump rooms.
- J. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as the feed conductor. Form conductor prior to cutting and provide at least 6-inches of tail and neatly packed in box after splice is made up.
- K. Branch circuits (#10 AWG and smaller):
 - 1. Connectors: Solderless, screw-on, reusable spring pressure cable type, 600volt, 105-degree C. with integral insulation, approved for copper conductors.
 - 2. The integral insulator shall have a skirt to completely cover the stripped wires.
 - 3. The number, size and combination of conductors as listed on the Manufacturers packaging shall be strictly complied with.
- L. Feeder circuits: (#6 to 750 kCMIL)
 - 1. Join or tap conductors from #6 AWG to 750 kCMIL using bolted pressure connectors or insulate mechanical compression (hi-press) taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of the joint.
 - 2. Terminate conductors from size #6 AWG to 750 kCMIL copper using bolted pressure or mechanical compression lugs in accordance with Manufacturer recommendation or as specified elsewhere.
 - 3. Field installed compression connectors for cable sizes 250 kCMIL and larger shall have not less than two clamping elements or compression indents per wire.
 - 4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulate with not less than that of the conductor level that is being joined.
- M. Termination hardware assemblies:

1. AL/CU lugs connected to aluminum plated or copper buss, shall be secured using a steel bolt, flat washer (two per bolt), Belleville washer and nut.
2. Copper lugs connected to copper bus, shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.
3. The crown of Belleville washers shall be under the nut.
4. Bolt assemblies shall be torque to Manufacturer recommendation. Where manufacture recommendations are not obtainable, the following values shall be used:
 - a. 1/4" - 20 bolt at 80-inch pounds torque.
 - b. 5/16" - 18 bolt at 180-inch pounds torque.
 - c. 3/8" - 16 bolt at 20-foot pounds torque.
 - d. 1/2" - 13 bolt at 40-foot pounds torque.Fp
 - e. 5/8" - 11 bolt at 55-foot pounds torque.
 - f. 3/4" - 10 bolt at 158-foot pounds torque.

3.06 IDENTIFICATION

- A. Refer to Section 260553: Electrical Identification for additional requirements.
- B. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.
- C. Color code conductors' size #8 and larger using specified phase color markers and identification tags, with exception of the grounded conductor which must have a continuous white or gray jacket if #6 or smaller.
- D. Provide all terminal strips with each individual terminal identified using specified vinyl markers.
- E. In pull boxes and handholes, provide tags of the embossed brass type and show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.07 FIELD QUALITY CONTROL

- A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein. Independent Testing Agency shall meet the requirements as outlined in Section 260010: Basic Electrical Requirements.
- B. Prefunctional testing:
 1. Visual and mechanical inspection:
 - a. Compare cable data with Contract Documents.
 - b. Inspect exposed sections of wires and cables for physical damage and proper connections.
 - c. Verify tightness of accessible bolted connections with calibrated torque wrench in accordance with Manufacturer's published data.

- d. Inspect compression applied connectors for correct cable match and indentation.
 - e. Verify visible cable bend meet or exceed ICEA and Manufacturer's minimum allowable bending radius.
 - f. If cables are terminated through window type current transformers, inspect to verify neutral and ground conductors are correctly placed for operation of protective devices.
 - g. Ensure wire and cable identification has been installed as specified herein.
2. Electrical testing:
- a. Contractor shall perform feeder and branch circuit insulation test after installation and prior to connection to utilization devices such as fixtures, motors, or appliances. Testing shall be as follows:
 - 1) 100% of all feeders 100amp rated and above.
 - 2) 50% of all feeders smaller than 100amps.
 - 3) 10% of all branch circuits at each individual panelboard.
 - b. Perform insulation-resistance test using megohm meter with applied potential of 1000volt DC for a continuous duration of 60-seconds. Test conductors' phase-to-phase and phase-to-ground. Conductors shall test free from short-circuit and ground faults.
 - c. Perform continuity test of all feeder and branch circuits to ensure correct cable connections. Test all neutrals for improper grounds.
 - d. Contractor shall furnish instruments, materials, and labor for these tests.
3. Test values: Investigate resistance values less than 50-megohms.
4. Furnish test results in typewritten report form for review and inclusion in the operation and maintenance manuals.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Power system grounding.
 - 2. Site lighting grounding.
 - 3. Electrical equipment and raceway grounding and bonding.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 05: Building Steel.
 - 3. Division 22: Cold Water Piping.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 467; Grounding and Bonding Equipment.
 - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - IEEE No. 142; Recommended Practice for Grounding of industrial and Commercial Power Systems.
 - IEEE No. 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

1.03 SYSTEM DESCRIPTION

- A. Ground the electrical service system neutral at service entrance equipment as described herein and indicated on Drawings.
- B. Ground each separately derived system neutral as described herein and indicated on Drawings.
- C. Except as otherwise indicated, the complete electrical installation including the neutral conductor, metallic conduits and raceways, cable trays, boxes, cabinets and equipment shall be completely and effectively grounded in accordance with all code requirements, whether or not such connections are specifically indicated or specified.
- D. Resistance:

1. Resistance from the main switchboard ground bus through the ground electrode to earth shall not exceed 5-OHMS unless otherwise noted.
2. Resistance from the farthest panelboard, switchboard, etc. ground bus through the ground electrode to earth shall not exceed 20-OHMS

1.04 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 3. Submit Manufacturer's installation instructions.

1.05 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Ground Rods:
 - a. Weaver.
 - b. Erico "Cadweld" Products, Inc.
 2. Ground Wells:
 - a. Christy Concrete Products, Inc.
 - b. Forni Corp.
 3. Ground Bushings, Connectors, Jumpers and Bus:
 - a. O-Z/Gedney.
 - b. Thomas & Betts Corp.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GROUND CONDUCTORS

- A. Refer to Specification Section 260519: Building Wire and Cable for conductor specifications.
- B. General purpose insulated:

1. UL approved and code sized copper conductor, with dual rated THHN/THWN insulation, color identified green.
 2. Where continuous color-coded conductors are not commercially available, provide a minimum 4" long color band with green, non-aging, plastic tape in accordance with CEC.
- C. Bare conductors in direct contact with earth or encased in concrete: #4/0 AWG copper minimum, U.O.N.
- D. Bonding pigtails: Insulated copper conductor, identified green, sized per code, and provide with termination screw or lug. Provide solid conductors for #10 AWG or smaller and stranded conductors for #8 AWG or larger.
- 2.03 DRIVEN (GROUND) RODS
- A. Copper clad steel, minimum 3/4-inch diameter by 8 feet long, unless otherwise noted.
- 2.04 GROUND WELL BOXES FOR GROUND RODS
- A. Precast concrete box nominal 9" throat diameter x 14" deep with light duty concrete cover for non-traffic areas or steel plate for traffic areas. Cover shall be embossed or engraved with "GROUND ROD".
- 2.05 INSULATED GROUNDING BUSHINGS
- A. Plated malleable iron or steel body with 150-degree Centigrade molded plastic insulating throat and lay-in grounding lug.
- 2.06 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPLICES
- A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds or high-pressure compression type connectors.
1. Exothermic welds shall be used for cable-to-cable and cable-to-ground rod and for cable to structural steel surfaces. Exothermic weld kits shall be as manufactured by Cadweld or equal. Each particular type of weld shall use a kit unique to that type of weld.
 2. High-pressure compression type connectors shall be used for cable-to-cable and cable-to-ground rod connections.
- 2.07 EXTRA FLEXIBLE, FLAT BONDING JUMPERS
- A. Where required by Code, indicated on the Drawing, and specified herein.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of grounding system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

- A. Grounding electrodes:

1. Metal underground water pipe: Cold water metal piping system: Where the underground cold water service line is metal, indirect contact with the earth for 10-feet or more, the Contractor shall install a grounding electrode conductor from the main incoming cold water line ahead of the meter and extend to the main building reference ground bus in the main electrical room. The electrode shall be sized per CEC Article 250. Electrode connection should be accessible.
 2. Concrete encased grounding electrode (UFER ground): Provide a #4/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings which are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. The electrode shall extend through a horizontal length of 30 feet minimum and shall be encased in not less than 2 or more than 5 inches of concrete separating it from surrounding soils. The electrode shall emerge from the concrete slab through a protective non-metallic sleeve and shall be extended to the main building reference ground bus.
 3. Supplementary grounding electrode (ground ring, grid and driven rods): Provide, as indicated on the Drawings, driven ground rod(s) installed in listed ground well box(s) and filled with gravel after connection is made. Interconnect ground rod with structural steel and adjacent rods with minimum #2 AWG bare copper conductor. Ground rod shall not be less than 10 foot from any other electrode of another electrical system or from adjacent ground rod(s).
- B. Grounding electrode conductor: Provide grounding electrode conductor as indicated on the Drawings or sized per CEC Article 250, whichever is greater.
- C. Power system grounding:
1. Provide, unless otherwise indicated, a ground rod and groundwell at the new electrical service. Connect the following items using CEC sized copper grounding conductors to lugs on the main building ground bus:
 - a. Grounding conductor from building reference ground bus in main panel.
 - b. Bonding conductor to metallic cold-water piping system.
 - c. Bonding conductor to building structural steel.
 - d. Separately derived system grounding conductors in same room.
 2. At the ground bus in the main panel, connect the grounding electrode conductor from concrete encased UFER ground or other grounding electrode systems as indicated on the Drawing or herein.
- D. Separately derived electrical system grounding:
1. Ground each separately derived system per requirements in CEC Article 250 as a minimum, unless greater requirements are required elsewhere in the Contract Documents.
 2. Transformers: Provide copper terminal bar for grounding and bonding the transformer in accordance with CEC Articles 250.30 and 450.10. Bond the terminal bar to the enclosure and connect the following to the terminal bar:
 - a. Primary feeder equipment ground conductor(s).
 - b. Secondary feeder supply-side bonding jumper(s).

- c. Grounding electrode conductor.
 - d. Main bonding jumper to neutral (when present).
 - e. Supplemental grounding electrodes.
- E. Equipment bonding/grounding:
- 1. Provide a CEC sized insulated copper ground conductor in all 120volt AC through 600volt AC feeder and branch circuit distribution conduits and cables.
 - 2. Provide a separate grounding bus at panelboards, switchboards. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35volts above ground.
 - 3. Conduit terminating in concentric, eccentric, or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.
 - 4. Provide bonding jumpers across expansion and deflection couplings in conduit runs, pipe connections to water meters, dielectric couplings in metallic cold-water piping system.
 - 5. Provide internal ground wire in flexible conduit connected at each end via grounding bushing.
- F. Site lighting grounding: Bond all metallic light poles and bollards. Provide ground rods where indicated on the Drawings.

3.03 FIELD QUALITY CONTROL

- A. Independent Testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing required herein.
- B. Prefunctional testing:
- 1. Provide Testing Agency with Contract Documents for their review prior to the commencement of ground testing.
 - 2. Visual and mechanical inspection:
 - a. The Testing Agency shall inspect the grounding electrode and connections prior to concrete encasement, burial, or concealment.
 - b. Check tightness and welds of all ground conductor terminations.
 - c. Verify installation complies with the intent of the Contract Documents
 - 3. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required complying with resistance limits specified under this Section of the Specification.
 - 4. A typewritten record of measured resistance values shall be submitted for review and included with the operation and maintenance manual furnished to the Owner at the time of Project closeout and before certificate of final payment is issued.

END OF SECTION

SECTION 260531

CONDUIT

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Rigid steel conduit and fittings.
 - 2. PVC insulated rigid steel conduit and fittings.
 - 3. Intermediate metal conduit and fittings.
 - 4. Electrical metallic tubing and fittings.
 - 5. Flexible metallic conduit and fittings.
 - 6. Liquidtight flexible metallic conduit and fittings.
 - 7. Miscellaneous conduit fittings and products.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 01: Cutting and patching.
 - 3. Division 07: Sheet metal flashing and trim.
 - 4. Division 09: Painting. Exposed conduit and other devices.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. American National Standards Institute, Inc. (ANSI):
 - ANSI C80.1; Rigid Steel Conduit, Zinc-Coated.
 - ANSI C80.3; Electrical Metallic Tubing, Zinc Coated.
 - ANSI/ TIA-569-D Telecommunications Pathways and Spaces.
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 1; Flexible Metal Conduit.
 - UL 6; Rigid Metal Conduit.
 - UL 360; Liquid-Tight Flexible Steel Conduit.
 - UL 514B; Conduit, Tubing and Cable Fittings.

- UL 635; Insulating Bushings.
- UL 797; Electrical Metallic Tubing - Steel.
- UL 1242; Intermediate Metal Conduit - Steel.

3. National Electrical Manufacturer Association (NEMA):

- NEMA RN1; PVC Externally coated Galvanized Rigid Steel Conduit.

1.03 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements the following items:

1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
3. Submit Manufacturer's installation instruction. Provide written instructions for raceway products requiring glues, special tools, or specific installation techniques.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.

1. Metal conduit:
 - a. Allied Tube and Conduit Co.
 - b. Triangle PWC, Inc.
 - c. Western Tube and Conduit Corp.
 - d. Spring City Electrical Manufacturing Co.
 - e. Alflec Corp.
 - f. American Flexible Metal Conduit Co.
 - g. Anaconda.
2. Fittings:
 - a. Appleton Electric Co.
 - b. OZ/Gedney.
 - c. Thomas & Betts Corp.

d. Spring City Electrical Manufacturing Co.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GALVANIZED RIGID STEEL CONDUIT (GRS)

- A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and UL 6.
- B. Standard threaded couplings, locknuts, bushings, and elbows: Only materials of steel or malleable iron are acceptable. Locknuts shall be bonding type with sharp edges for digging into the metal wall of an enclosure; provide two locknuts at each box or can, inside and outside.
- C. Three-piece couplings: Hot dip galvanized, cast malleable iron.
- D. Insulating bushings: Threaded polypropylene or thermosetting phenolic rated 150-degree C minimum.
- E. Insulated grounding bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
- F. Insulated metallic bushings: Threaded cast malleable iron body with plastic insulated throat rated 150-degrees C.
- G. All fittings and connectors shall be threaded.

2.03 PVC INSULATED GALVANIZED RIGID STEEL CONDUIT (PVC GRS)

- A. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
- B. Fittings: Conduit couplings and connectors shall be as specified for galvanized rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

- A. Conduit: Hot dip galvanized steel meeting the requirements of CEC Article 345 and conforming to ANSI C80.6 and UL 1242.
- B. Fittings: Conduit couplings, connector and bushing shall be as specified for galvanized rigid steel conduit. Integral retractable type IMC couplings are also acceptable.

2.05 ELECTRICAL METALLIC TUBING (EMT)

- A. Conduit: Shall be formed of cold rolled strip steel, electrical resistance welded continuously along the longitudinal seam and hot dip galvanized after fabrication. Conduit shall conform to ANSI C80.3 Specifications and shall meet UL requirements.
- B. Set screw type couplings: Hot dip galvanized, steel, UL listed concrete tight. Use set screw type couplings with four setscrews each of conduit sizes over 2 inches. Setscrews shall be of case-hardened steel with hex-head and cup point to firmly seat in wall of conduit for positive grounding.

- C. Set screw type connectors: Hot dip galvanized, steel, UL listed concrete tight with male hub and insulated plastic throat, 150-degree C temperature rated. Setscrew shall be same as for couplings.
- D. Raintight couplings: Hot dip galvanized, steel; UL listed raintight and concrete tight, using gland and ring compression type construction.
- E. Raintight connectors: Hot dip galvanized, steel, UL listed raintight and concrete tight, with insulated throat, using gland and ring compression type construction.

2.06 FLEXIBLE METALLIC CONDUIT (FMC)

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strip, spirally wound and formed to provide an interlocking design and conforming to UL 1.
- B. Fittings: Connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Exception: Pressure cast screw-in connectors shall be acceptable for luminaire connection in suspended ceilings and cut-in outlet boxes within existing furred walls.

2.07 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC)

- A. Conduit: Shall be fabricated in continuous lengths from galvanized steel strips, interlocking spirally wound, covered with extruded liquidtight jacket of polyvinyl chloride (PVC) and conforming to UL 360. Provide conduit with a continuous copper-bonding conductor wound spirally between the convolutions.
- B. Fittings: Connector body and gland nut shall be of cadmium plated steel or cast malleable iron, with tapered, male, threaded hub; insulated throat and neoprene "O" ring gasket recessed into the face of the stop nut. The clamping gland shall be of molded nylon with an integral brass push-in ferrule.

2.08 MISCELLANEOUS CONDUIT FITTINGS AND PRODUCTS

- A. Watertight conduit entrance seals: Steel or cast malleable iron bodies and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Fittings shall be supplied with neoprene sealing rings between the body and PVC sleeve.
- B. Watertight cable sealing bushings: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel sealing screws and zinc plated cast malleable iron locking collar.
- C. Expansion fittings: Multi-piece unit comprised of a hot dip galvanized malleable iron or steel body and outside pressure bussing designed to allow a maximum of 4" conduit movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. Unit shall be UL listed for wet or dry locations.
- D. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve with internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling shall accommodate 0.75-inch deflection, expansion or contraction in any direction and allow 30-degree angular deflections. Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber jacket and stainless-steel jacket clamps. Unit shall comply with UL467 and UL514. Manufacturer shall be OZ/Gedney Type DX, Steel City Type EDF or equal.

- E. Fire rated penetration seals:
 - 1. UL building materials directory classified.
 - 2. Conduit penetrations in fire rated separation shall be sealed with a UL classified fill, void or cavity material.
 - 3. The fire rated sealant material shall be the product best suited for each type of penetration and may be a caulk, putty, composite sheet, or wrap/strip.
- F. Standard products not herein specified:
 - 1. Provide listing of standard electrical conduit hardware and fittings not herein specified for approval prior to use or installation, i.e. locknuts, bushings, etc.
 - 2. Listing shall include Manufacturers name, part numbers and a written description of the item indicating type of material and construction.
 - 3. Miscellaneous components shall be equal in quality, material and construction to similar items herein specified.
- G. Hazardous area fittings: UL listed for the application.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of conduit system installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 APPLICATION

- A. Galvanized rigid steel conduit (GRS) can be used in the following applications:
 - 1. For feeders and branch circuits located indoors, concealed or exposed above suspended ceilings, in damp/wet locations, in crawl spaces, in attics, chases, furred spaces, equipment rooms, loading docks or in hazardous locations in accordance with CEC and local Codes.
 - 2. For feeders and branch circuits concealed in concrete floors and walls when not in contact with earth.
 - 3. For use where conduit is subject to physical damage.
 - 4. For feeders and branch circuits installed exposed on the roof.
- B. PVC insulated galvanized rigid steel conduit can be used in the following applications:
 - 1. Use 40-mil coating for feeders and branch circuits in damp or wet locations.
 - 2. Use 20- or 40-mil for feeders and branch circuits concealed in concrete walls or slabs in contact with earth.
 - 3. Use 20- or 40-mil for runs beneath floor slabs on grade.
 - 4. Use 40-mil for all below grade penetrations through floor slabs on grade or exterior walls.

- C. Intermediate metal conduit (IMC): Can be used for the same application as galvanized rigid steel conduit as specified herein, except for hazardous locations prohibited by CEC or Local Codes.
- D. Electrical metallic tubing (EMT): Can be used exposed or concealed for interior electrical feeders 4" and smaller, interior power and lighting branch circuits and low tension distribution system where run above suspended ceilings, in concrete slabs and walls not in contact with earth; in stud walls, furred spaces and crawl spaces. EMT shall not be installed exposed below 8 feet above the finish floor except within electrical, communication or signal rooms or closets (subject to physical damage).
- E. Flexible metallic conduit (FMC): Can be used only in dry locations for connections from an adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices and to luminaires installed in suspended ceilings.
- F. Liquidtight flexible metallic conduit (LFMC): Can be used in wet or damp locations for connections from adjacent outlet box or conduit to all motors, transformers, vibrating equipment or machinery, controllers, solenoid valves, float and flow switches or similar devices. These areas are typically food preparation and dishwashing areas, sump wells, loading docks, pump rooms, exterior areas, etc.
- G. Fire-Resistive Systems: Refer to CEC Article 728. All devices utilized, mountings, and supports shall be listed as part of the fire-resistive system.

3.03 PREPARATION

- A. Locations of conduit runs shall be planned in advance of the installation and coordinated with ductwork, plumbing, ceiling and wall construction in the same areas and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, nor block access to mechanical or electrical equipment.
- B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary offsets.
- C. All conduits shall be run parallel or at right angles to the centerlines of columns and beams, whether routed exposed, concealed above suspended ceiling or in concrete slabs.
- D. Conduits shall not be placed closer than 12-inches to a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- E. Communications conduits shall not be placed closer than 12 inches to power, a flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- F. Exposed conduit installation shall not encroach into the ceiling height headroom of walkways or doorways. Where possible, install horizontal raceway runs above water and below steam piping.
- G. The largest trade size conduits in concrete floor and wall slabs shall not exceed 1/3 the floor or wall thickness and conduits shall be spaced a minimum of three conduit diameters apart unless otherwise noted on the Drawings. All conduits shall be installed in the center of

- concrete slabs or wall and shall not be placed between reinforcing steel and the bottom of floor slabs.
- H. In long runs of conduit, provide sufficient pull boxes inside buildings to facilitate pulling wires and cables, with spacing not to exceed 150-feet. Support pull boxes from structure independent of conduit supports. These pull boxes are not indicated on the Drawings.
 - I. Provide all reasonably inferred standard conduits fitting and products required to complete conduit installation to meet the intended application whether noted, indicated, or specified in the Contract Documents or not.
 - J. Connect recessed luminaires to conduit runs with maximum six feet of flexible metal conduit.

3.04 INSTALLATION

- A. Install conduit in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Minimum Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 3/4" for interior applications and 1" for exterior and underground applications.
- C. Minimum Communication and Signal Conduit Size: Unless otherwise noted herein or on Drawings, minimum conduit size shall be 1" for interior applications and 2" for exterior and underground applications.
- D. All conduit sizes indicated on the Drawings are sized for copper conductors with THHN/THWN insulation. If conductor type or size is changed the Contractor shall be responsible for resizing conduits upward to meet Code.
- E. All communication and signal conduit sizes indicated on the Drawings are sized for 40% fill or less for category 6 or 6A cable. If cable type or size is changed the Contractor shall be responsible for resizing conduits upward to meet a maximum 40% fill.
- F. In general, all conduit work shall be concealed where possible. Exceptions shall be electrical, communication and mechanical rooms, exposed ceiling areas, and parking garages.
- G. Conduit connections to motors and surface cabinets shall be concealed, except for electrical, communication and mechanical rooms, or unless exposed Work is clearly called for on the Drawings.
- H. Install conduits in complete runs before pulling in cables or wires.
- I. Install conduit free from dented, bruises or deformations. Remove and replace any damaged conduits with new undamaged material.
- J. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.
- K. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading. Coat all field-threaded joints with UL approved conductive type compound to ensure low resistance ground continuity through conduit and to prevent seizing and corrosion.
- L. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field-threaded joints to prevent corrosion.

- M. In all empty conduits or ducts, install a “True Tape” conduit measuring tape line to provide overall conduit length for determining length of cables/conductors for future use.
- N. Conduit systems shall be mechanically and electrically continuous throughout. Install code size, insulated, copper, green-grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not indicated on the Drawings. Refer to Section 260526: Grounding and Bonding.
- O. Metallic conduit shall not be in contact with other dissimilar metal pipes (i.e. plumbing).
- P. Make bends with standard conduit bending hand tool or machines. The use of any item not specifically designed for the bending of electrical conduit is strictly prohibited.
- Q. A run of conduit between terminations at wire pulling points shall not contain more than the equivalent of four quarter bends (360-degrees, total).
- R. A run of communications and signal conduit between terminations at wire pulling points shall not contain more than the equivalent of two quarter bends (180-degrees, total).
- S. Emergency power raceway system: Install entirely independent of other raceway systems, except where specifically allowed by CEC Article 517.

3.05 PENETRATIONS

- A. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, wall, etc. Penetrations are acceptable only when the following occurs:
 - 1. Where indicated on the Structural Drawings.
 - 2. As approved by the Structural Engineer prior to construction and after submittal of Drawing showing location, size, and position of each penetration.
- B. Cutting or holes:
 - 1. Cut holes through concrete, masonry block or brick floors and floors of structure with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space. Obtain the approval of the Structural Engineer prior to drilling through structural sections.
 - 2. Provide sleeves or “can outs” for cast-in-place concrete floors and walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack grouting compounds; or fire rated penetration-sealing materials.
 - 3. Cut holes for conduit penetrations through non-concrete and non-masonry walls, partitions, or floors with a hole saw. The hole shall be only as large as required to accommodate the size of the conduit.
 - 4. Provide single piece escutcheon plates around all exposed conduit penetrations in public places.
- C. Sealing:
 - 1. Non-rated penetrations: Pack opening around conduits with non-flammable insulating material and seal with gypsum wallboard taping compound.

2. Fire stop: Where conduits, wireways and other electrical raceways pass through fire rated partitions, walls, smoke partitions or floor; install a UL classified fire stop material to provide an effective barrier against the spread of fire, smoke, and gases. Completely fill and seal clearances between raceways and openings with the fire stop material.
- D. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Division 07: Sealants and Caulking.
1. Install specified watertight conduit entrance seals at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be PVC coated rigid galvanized steel.
 2. For roof penetrations furnish and install roof flashing, counter flashing and pitch-pockets as specified under Roofing and Sheet Metal Sections of the Specifications.
 3. Provide membrane clamps and cable sealing fittings for any conduit that horizontally penetrates the waterproof membrane.
 4. Conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration on the exterior side a minimum of two times the conduit diameters.

3.06 CONCEALED IN CONCRETE

- A. Install conduits approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the conduits.
- B. Installation of conduit in structural concrete that is less than three inches thick is prohibited. Topping slabs, maintenance pads and curbs are exempted.
- C. Tie conduits to reinforcing rods or otherwise secure them to prevent sagging or shifting during concrete placement. Run conduit larger than 1-inch trade size, parallel with or at right angles to the main reinforcement; where at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab.
- D. Where nonmetallic conduit or tubing is used, raceways must be converted to PVC coated rigid steel conduit before rising above floor.
- E. Make couplings and connections watertight.
- F. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

3.07 TERMINATIONS AND JOINTS

- A. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.
- B. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
- C. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Where

- terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.
- D. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.
 - E. Stub-up connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor. Where equipment connections are not made under this contract, install screwdriver operated threaded flush plugs with floor.
 - F. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets, or gutters inside the building. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction, or outlet boxes.
 - G. Raceway seal: Inject into wire filled raceways, a pre-formulated rigid 2 lbs. density polyurethane foam which expands a minimum 35 times its original bulk. Foam shall have the physical properties of water vapor transmission of 1.2 to 3.0 perms: water absorption less than 2% by volume, fungus and bacterial resistant. Foam shall permanent seal against water, moisture, insects, and rodents. Install raceway sealing foam at the following points:
 - 1. Where conduits pass from warm locations to cold locations to prevent passage of water vapor (such as refrigerated spaces, constant temperature rooms, air-conditioned spaces, etc.).
 - 2. Where conduits enter buildings from below grade.
 - H. Install expansion couplings where any conduit crosses a building separation or expansion joint as follows:
 - 1. Conduits three inches and larger, shall be rigidly secured to the building structure on opposite sides of a building expansion joint and provided with expansion or deflection couplings. Install the couplings in accordance with the Manufacturer's recommendations.
 - 2. Conduits smaller than three inches shall be rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 15 inches of slack flexible conduit. Flexible conduit shall have a green copper ground-bonding jumper installed. For concrete embedded conduit, use expansion and deflection couplings as specified above for three inches and larger conduits.
 - I. Use short length (maximum of 6ft) of the appropriate FMC or LFMC conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquidtight flexible metal conduit for installation in exterior locations, moisture or humidity-laden atmosphere, corrosive atmosphere, water hose or spray wash-down operations and locations subject to seepage or dripping of oil, grease, or water. Provide a green ground wire with FMC or LFMC conduit.

3.08 SUPPORTS

- A. Provide supports for raceways as specified in Section 260529: Electrical Hangers and Supports.
- B. All raceways systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to the CEC.
- C. Support single runs of conduit using one-hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp backs" to space conduit off the surface.
- D. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from specified construction channel, mounted to 3/8-inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one-hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.
- E. Individual 1/2" and 3/4" conduits installed above suspended ceilings may be attached to the ceiling's hanger wire using spring steel support clips provided that not more than two conduits are attached to any single support wire.
- F. Support exposed vertical conduit runs at each floor level, independent of cabinets or switches to which they run, by means of acceptable supports.
- G. Fasteners and supports in solid masonry and concrete:
 - 1. Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
 - 2. After concrete installation:
 - a. Steel expansion anchors not less than ¼ inch bolt size and not less than 1-1/8" embedment.
 - b. Power set fasteners not less than ¼ inch diameter with depth of penetration not less than three inches.
 - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- H. Hollow masonry: Toggle bolts are permitted. Bolts supported only by masonry block are not acceptable.
- I. Metal structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

END OF SECTION

SECTION 26 05 33

BOXES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Wall and ceiling outlet boxes.
 - 2. Pull and junction boxes.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 08: Access doors. Wall and ceiling access doors.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. American National Standards Institute/National Electrical Manufacturer Association:
 - ANSI/NEMA OS-1; Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
 - ANSI/NEMA OS-2; Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
 - NEMA 250; Enclosures for Electrical Equipment (1000 volts maximum).
 - 2. Underwriters Laboratories (UL):
 - UL 50; Enclosures for Electrical Equipment.
 - UL 514A; Metallic Outlet Boxes.
 - UL 1773; Termination Boxes.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Submit Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Outlet and junction boxes:
 - a. Spring City Electrical Manufacturing Co.
 - b. Thomas & Betts Corp.
 - c. Raco, Inc.
 - 2. Cast boxes:
 - a. Appleton Electric Co.
 - b. Crouse-Hinds.
 - 3. Pullboxes:
 - a. Circle AW Products.
 - b. Hoffman Engineering Co.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 OUTLET BOXES

- A. Standard outlet box:
 - 1. Provide galvanized, one-piece die formed or drawn steel or welded, knockout type box of size and configuration best suited to the application indicated on the Drawings.
 - 2. 4-inch square by 2-1/4-inch deep shall be minimum box size.
 - 3. ANSI/NEMA OS 1.
- B. Concrete box:
 - 1. Provide galvanized steel, 4-inch octagon rings with mounting lugs, backplate and adapter ring as required.
 - 2. Select height as necessary to position knockouts above concrete reinforcing steel.
 - 3. ANSI/NEMA OS 1.
- C. Cast metal outlet boxes:
 - 1. Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
 - 2. Provide galvanized cast iron alloy with threaded hubs and mounting lugs as required.
 - 3. Provide boxes with cast cover plates of the same material as the box and neoprene cover gaskets.

- D. Conduit outlet body: Provide malleable iron, oblong conduit outlet bodies with threaded conduit hubs and neoprene gasket, cast iron covers.

2.03 PULL AND JUNCTION BOXES

- A. Sheet metal pull and junction box:
 - 1. Provide standard outlet or concrete ring boxes wherever possible; otherwise use minimum 16-gauge galvanized sheet metal, NEMA 1 boxes, sized to Code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
 - 2. ANSI/NEMA OS 1.
- B. Flush mounted pullboxes and junction boxes: Provide overlapping covers with flush head cover retaining screws, prime coated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of box installation to verify conformance with Manufacturer and Specification tolerances. Do not commence installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Install all outlet boxes flush with building walls, ceilings, and floors except where boxes are installed in mechanical and electrical rooms, in cabinetry, above accessible ceilings or where exposed Work is called for on the Drawings.
- B. Locate pullboxes and junction boxes in concealed locations above removable ceilings or exposed in electrical rooms, utility rooms or storage areas.
- C. Install outlet boxes at the locations and elevations indicated on the Drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
- D. Locate switch outlet boxes on the latch side of doorways unless otherwise indicated.
- E. Locate outlet boxes above hung ceilings having concealed suspension systems, adjacent to openings for removable recessed luminaires.
- F. Do not install outlet boxes back-to-back, separate boxes by at least 6". In fire-rated walls separate boxes by at least 24" and wall stud.
- G. Adjust position of outlet boxes in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for boxes.

3.03 INSTALLATION

- A. Install boxes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Locate electrical boxes as indicated on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.
- C. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Note that these boxes are not indicated on the Drawings.

- D. Install raised covers (plaster rings) on all outlet boxes in stud walls or in furred, suspended, or exposed concrete ceilings. Covers shall be of a depth to suit the wall or ceiling finish.
- E. Leave no unused openings in any box. Install close-up plugs as required to seal openings.
- F. Provide cast metal boxes with gasketed cast metal cover plates where boxes are exposed in damp or wet locations.
- G. Welded outlet boxes shall only be used in concealed interior installations.
- H. Provide precast concrete boxes in exterior planting areas, walkways, roads etc.
- I. Provide an access panel in permanent ceiling or wall where boxes are installed and will be inaccessible.
- J. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes to prevent condensation in boxes.
- K. For outlets mounted above counters, benches or backsplashes, coordinate location and mounting heights with built-in units. Adjust mounting height to agree with required location for equipment served.
- L. Use conduit outlet bodies to facilitate pulling of conductors or to make changes in conduit direction only. Do not make splices in conduit outlet bodies.
- M. Add additional sheet rock as necessary to maintain original fire rating of walls where boxes are installed.
- N. Install galvanized steel coverplates on boxes in unfinished areas, above accessible ceilings and on surface mounted outlets.

3.04 SUPPORTS

- A. Provide boxes installed in metal stud walls with brackets designed for attaching directly to the studs or mount boxes on specified box supports.
- B. Mount boxes, installed in suspended ceilings of gypsum board or lath and plaster construction, to 16-gauge metal channel bars attached to main ceiling runners.
- C. Support boxes independently of conduit system.
- D. Support boxes, installed in suspended ceilings supporting acoustical tiles or panels, directly from the structure above wherever pendant mounted luminaires are to be installed from the box.
- E. Support boxes mounted above suspended acoustical tile ceilings, directly from the structure above.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
1. Underground conduits and ducts.
 2. Handhole and pullboxes.
 3. Excavation, trenching and backfill.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 2. Division 31 - Earthwork: General requirements for Excavation and Backfill and related items for ducts, manholes, pullboxes and handholes.
 3. Division 03 - Cast-in-place concrete: Protective envelope for ducts.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
1. American Concrete Institute (ACI):
ACI 318; Building Code Requirements for Structural Concrete
 2. American National Standards Institute, Inc. (ANSI):
 3. American Society for Testing And Materials (ASTM):
ASTM C31; Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39; Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C172; Standard Practice for Sampling Freshly Mixed Concrete
ASTM C192; Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231; Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C478; Specification for Precast Reinforced Concrete Manhole Sections
ASTM C805; Test Method for Rebound Number of Hardened Concrete

- | | |
|-------------|--|
| ASTM C857; | Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures |
| ASTM C858; | Specification for Underground Precast Concrete Utility Structures |
| ASTM C877; | Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections |
| ASTM C891; | Practice for Installation of Underground Precast Concrete Utility Structures |
| ASTM C990; | Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants |
| ASTM C1037; | Practice for Inspection of Underground Precast Concrete Utility Structures |
| ASTM C1064; | Standard Test Method for Temperature of Freshly Mixed Concrete |
| ASTM C1231; | Standard Practice for Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinder |
| ASTM C1611; | Standard Test Method for Slump Flow of Self-Consolidating Concrete |
4. Underwriters Laboratories, Inc. (UL):
- | | |
|---------|---------------------------------------|
| UL 651; | Schedule 40 and 80 Rigid PVC Conduit. |
|---------|---------------------------------------|
5. National Electrical Manufacturer Association (NEMA):
- | | |
|------------|---|
| NEMA RN1; | PVC Externally-coated Galvanized Rigid Steel Conduit. |
| NEMA TC 2; | Electrical Plastic Tubing and Conduit. |
| NEMA TC 3; | PVC Fittings for use with Rigid PVC Conduit. |
| NEMA TC6; | PVC Plastic Utilities Duct (EB and BD Type). |

1.03 DEFINITIONS

- A. Duct: Electrical conduit and other raceway, either metallic or nonmetallic, used underground embedded in earth.
- B. Duct bank: Two or more conduits or another raceway installed underground in same trench.
- C. Handhole: An underground junction box in a duct or duct bank.

1.04 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 3. Shop Drawings showing details and design calculations for precast handholes, including reinforced steel.
 4. Submit Manufacturer's installation instructions.

5. Complete bill of material listing all components.

1.05 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted and approved.
- C. Precast concrete vaults shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete units similar to that indicated in the project specifications or drawings for at least 10 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Underground precast concrete utility structures:
 - a. Oldcastle Enclosure Solutions.
 - b. Jensen Precast.
 - 2. Conduits, ducts and fittings:
 - a. Prime Conduit.
 - b. JM Eagle.
 - c. Cantex.
 - d. Occidental Coating Company (OCAL).
- B. Substitution: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 CONDUIT AND DUCT

- A. Refer to Section 260531: Conduit.
- B. Galvanized rigid steel conduit (GRS) in underground installations:
 - 1. PVC insulated galvanized rigid steel conduit (PVC GRS):
 - a. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with nominal 20 or 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
 - b. Fittings: Conduit couplings and connectors shall be steel or malleable iron as required with factory PVC coating and insulated jacket equivalent to that of the coated material.
 - 2. Tape insulated galvanized rigid steel conduit (Tape GRS):
 - a. Conduit: Full weight, threaded, hot-dip galvanized steel, conforming to ANSI C80.1 and NEMA RN-1 with half lapping of PVC 10 mil tape over the exterior of the conduit. Half lap all raceways a minimum of one time and extend to 12-inches above grade.

- b. Fittings: Conduit couplings and connectors shall be steel or malleable iron as required with half lapping of PVC 10 mil tape over the exterior of the fittings. Half lap shall extend to 12-inches above grade.
- C. Rigid non-metallic conduit (PVC):
 - 1. Conduit:
 - a. Rigid polyvinylchloride, schedule 40 or 80 conforming to NEMA TC2 and UL 651. UL listed for exposed and direct-burial applications and for 90 degrees C conductor insulation. Conduit shall include an integral bell fitting at one end.
 - b. Rigid polyvinylchloride, type EB or DB conforming to NEMA TC 6 and UL 651. UL listed for concrete encased burial and direct burial applications and for 90 degree C conductor insulation. Conduit shall include an integral bell fitting at one end.
 - 2. Fittings: Couplings, adaptors, transition fittings, bell ends, etc., shall be molded PVC, slip on and solvent weld type. Schedule 40 or 80 conforming to NEMA TC 3 and type EB or DB conforming to NEMA TC 9.
- D. Elbows:
 - 1. Low voltage systems (1000 volts and less):
 - a. Minimum radius bends shall be 18" for conduits up to 2" diameter, 36" for conduits greater than 2" diameter, or greater if indicated on the drawings or required by the cable manufacturer.
- E. Duct supports: Rigid PVC spacers selected to provide minimum duct spacing and concrete cover depths, while supporting ducts during concrete pour.
- F. Duct sealing compound: Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 degree F, withstands temperature of 300 degrees F without slump and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, cable sheaths and jackets, etc.

2.03 PULLBOXES AND HANDHOLES

- A. Construction: High densities precast reinforced concrete box, extension, base, and cover. Furnish box with end and side knockouts and non-settling shoulders. Cover shall have hold-down bolts and two lifting eyes.
- B. Size: As indicated on the Drawings.
- C. Cover markings: Covers shall read "ELECTRICAL", "COMMUNICATIONS", or "SIGNAL" as appropriate.
- D. Rated covers: Use cast iron lid with H20 traffic rating when subject to vehicular traffic.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of duct and manhole installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 EARTHWORK

- A. Excavation and backfill: Conform to Division 31, Earthwork.

- B. Excavation for underground electrical structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus, a sufficient distance to permit placing and removal of concrete formwork, installation or services, other construction and for inspection.
 - 1. Excavate, by hand, areas within dripline of large trees. Protect the root system for damage and dry-out. Maintain moist conditions for root system and over exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 - 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- C. Trenching: Excavate trenches for electrical installation as follows:
 - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearances on both sides of raceways and equipment.
 - 2. Excavate trenches to depth indicated or required.
 - 3. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
 - 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
- D. Backfilling and filling: Place soil materials in layers to required sub-grade elevations for each area classification, using materials and methods specified in Division 31: Earthwork.
 - 1. Under building slabs, use drainage fill materials.

3.03 CONDUIT AND DUCT INSTALLATION

- A. Install duct lines in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Application:
 - 1. Direct burial ducts: Schedule 40, minimum 24-inches below finished grade.
 - 2. Below building slab-on-grade: Schedule 40, minimum 4-inches below bottom of slab except that bends and penetrates through floor slab shall be insulated galvanized rigid steel conduit.
 - 3. Below roads and paved surfaces:
 - a. Schedule 80, minimum 36-inches below finished grade.
 - 4. Penetrations of building and equipment slabs: Insulated galvanized rigid steel conduit .
- C. Slope duct to drain towards handholes and away from building and equipment entrances. Pitch not less than 4-inches per 100-feet.
- D. Curved sections in duct lines shall consist of long sweep bends with a minimum radius of 25-feet in the horizontal and vertical directions. The use of manufactured bends is limited to building entrances and equipment stub-ups.
- E. For communications and signal conduits, do not exceed a combined bend radius of greater than 180 degrees between pull points.
- F. Underground conduit stub-ups to inside of building and exterior equipment shall be insulated galvanized rigid steel conduit.

- G. Make joints in ducts and fittings watertight according to Manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.
- H. Terminate duct lines at handholes with end bells spaced 10-inches on center for 5-inch ducts and varied proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10-feet from the end bell without reducing duct line slope and without forming trap in the line.
- I. Separation between direct buried duct lines shall be 3-inches minimum for like systems and 12-inches minimum between power and signal ducts.
- J. For direct burial installations install continuous warning strip of heavy gage plastic imprinted "electrical ducts below", approximately 12-inch wide at 12-inches above ducts.
- K. Mandrel all ducts upon completion of installation and prior to pulling cables.

3.04 HANDHOLE AND PULL BOX INSTALLATION

- A. Install handholes in accordance with Manufacturer's written instructions, as indicated on Drawings and as specified herein.
- B. Handholes shall be installed flush with finished grade or surface. Install on a level 6-inch bed of well-tamped gravel or crushed stone.
- C. Orientation of handholes shall be coordinated in advance with Landscape Architect and arranged to minimize connecting duct bends and deflections.

3.05 FIELD QUALITY CONTROL

- A. Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and structures.
 - 1. Duct integrity: Rod ducts with a mandrel 1/4-inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest.

3.06 CLEANING

- A. Pull brush through full length of ducts. Use round bristle brush with a diameter 1/2-inch greater than internal diameter of duct.
- B. Clean internal surfaces of handholes. Remove foreign material.

END OF SECTION

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Electrical equipment nameplates.
 - 2. Panelboard directories.
 - 3. Wire and cable identification.
 - 4. Buried electrical line warnings.
 - 5. Junction box identification.
 - 6. Inscribed device coverplates.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 09: Painting.

1.02 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein.
 - 2. Schedules for nameplates to be furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Conduit and wire markers:
 - a. Thomas & Betts Corp.
 - b. Brady.
 - c. Griffolyn.
 - 2. Inscription Tape:

- a. Kroy.
- b. Merlin.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 NAMEPLATES

A. Type NP: Engraved, plastic laminated labels, signs, and instruction plates. Engrave stock melamine plastic laminate 1/16-inch minimum thickness for signs up to 20-square inches or 8-inches in length; 1/8-inch thick for larger sizes. Engraved nameplates shall have white letters and be punched for mechanical fasteners.

B. Color and letter height as specified in Part 3: Execution.

2.03 LEGEND PLATES

A. Type LP: Die-stamped metal legend plate with mounting hole and positioning key for panel mounted operator devices, i.e. motor control pilot devices, hand-off-auto switches, reset buttons, etc.

B. Stamped characters to be paint filled.

2.04 BRASS TAGS

A. Type BT: Metal tags with die-stamped legend, punched for fastener.

B. Dimensions: 2" diameter 19 gauge.

2.05 PANELBOARD DIRECTORIES (400 AMP OR LESS)

A. Directories: A 6" x 8" minimum size circuit directory frame and card with clear plastic covering shall be provided inside the inner panel door.

B. Circuit numbering: Starting at the top, odd numbered circuits in sequence down the left-hand side and even numbered circuits down the right-hand side. Multi-section panelboards shall have continuous consecutive circuit numbers, i.e. Section 1 (circuit numbers 1-42), Section 2 (circuit numbers 43-84), Section 3 (circuit numbers 85-126) for all 42-pole panelboards. For 84-pole panelboards the numbering is Section 1 (circuit numbers 1-84), Section 2 (circuit numbers 85-168), etc.

2.06 WIRE AND TERMINAL MARKERS

A. Provide self-adhering, pre-printed, machine printable or write-on, self-laminating vinyl wrap around strips.

B. Blank markers shall be inscribed using the printer or pen recommended by Manufacturer for this purpose.

2.07 CONDUCTOR PHASE MARKERS

A. Colored vinyl plastic electrical tape, 3/4" wide, for identification of phase conductors. Scotch 35 Brand Tape or equal.

2.08 UNDERGROUND CONDUIT MARKER

A. 6-inch wide, yellow polyethylene tape, with continuous black imprinting reading "Caution - Buried Electric Line Below".

2.09 INSCRIBED DEVICE COVERPLATES

- A. Coverplate material shall be as specified in Section 262726: Wiring Devices.
- B. Methods of inscription: (Unless otherwise noted)
 - 1. Type-on-tape:
 - a. Imprinted or thermal transfer characters onto tape lettering system.
 - b. Tape trimmer.
 - c. Matte finish spray-on clear coating.
 - 2. Engraving:
 - a. 1/8" high letters.
 - b. Paint filled letters finished in black.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Contractor shall thoroughly examine Project site conditions for acceptance of identification device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 NAMEPLATES

- A. Installation:
 - 1. Degrease and clean surfaces to receive nameplates.
 - 2. Install nameplates parallel to equipment lines.
 - 3. Secure nameplates to equipment fronts using machine screws.
- B. Provide type 'NP' color coded nameplates that present, as applicable, the following information:
 - 1. Equipment or device designation:
 - 2. Amperage, KVA or horsepower rating, where applicable.
 - 3. Voltage or signal system name.
 - 4. Source of power or control.
- C. Nameplates for power system distribution equipment and devices are to be black.
- D. Nameplates for signal systems equipment and devices are to be black.
- E. Minimum letter height shall be as follows:
 - 1. For panelboards, etc.: ½ inch letters to identify equipment designation. Use ¼ inch letters to identify voltage, phase, wires, etc.
 - 2. For individual mounted circuit breakers, disconnect switches, enclosed switches and motor starters use 3/8-inch letters to identify equipment designation. Use 1/8" letters to identify all other.

3. For transformers use ½-inch letters to identify equipment designation. Use ¼-inch letters to identify primary and secondary voltages, etc.
4. For equipment cabinets, terminal cabinets, control panels and other cabinet enclosed apparatus use 3/8-inch letters to identify equipment designation.

3.03 LEGEND PLATES

- A. Provide panel-mounted operators devices such as pilot lights, reset buttons, "HAND-OFF-AUTO" switches, etc.

3.04 BRASS TAGS

- A. Provide type BT tags for individual ground conductors to exposed ground bus indicating connection i.e. "UFER", "Cold water bond", etc.
- B. Provide tags for all feeder cables in underground vaults and pull boxes.
- C. Provide tags for empty conduits in underground vault, pull boxes and stubs.

3.05 PANELBOARD DIRECTORIES (400AMP OR LESS)

- A. Provide typewritten directories arranged in numerical order denoting loads served by room number or area for each circuit.
- B. Verify room numbers or area designation with Project Manager.
- C. Mount panelboard directories in a minimum 6" x 8" metal frame under clear plastic cover inside every panelboard.

3.06 WIRE AND CABLE IDENTIFICATION

- A. Provide wire markers on each conductor in panelboards, pull boxes, outlet, and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits and with control wire number as indicated on equipment Manufacturer's Shop Drawings for control wiring.
- B. Provide colored phase markers for conductors as noted in Section 260519: Building Wire and Cable. Apply colored, pressure sensitive plastic tape in half-lapped turns for a distance of 3-inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not cover cable identification markings by taping.

3.07 UNDERGROUND CONDUIT MARKERS

- A. During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground plastic line marker, located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

3.08 JUNCTION BOX IDENTIFICATION

- A. The cover of junction, pull and connection boxes for both power and signal systems, located above suspended ceilings and below ceilings in non-public areas, shall be clearly marked with a permanent ink felt pen. Identify the circuit(s) (panel designation and circuit numbers) contained in each box, unless otherwise noted or specified.

3.09 INSCRIBED DEVICE COVERPLATE

A. General:

1. Lettering type: Helvetica, 12 point or 1/8" high.
2. Color of characters shall be black.
3. Locate the top of the inscription 1/2" below the top edge of the coverplate.
4. Inscription shall be centered and square with coverplate.

B. Application:

1. Type-on-tape inscriptions shall be provided for the following devices:
 - a. Receptacles.
 - b. Telecommunication outlets.
2. Type-on-tape installation:
 - a. Tape shall be trimmed to the height of the letters.
 - b. Trim tape length to 1/4-inch back from each edge of coverplate.
 - c. Contractor hands shall be clean or covered with surgical type glove prior to application of tape. Tape installations with visible fingerprints or smudges will not be acceptable.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Wall switches.
 - 2. Receptacles.
 - 3. Coverplates.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.
 - 1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
 - 2. Division 03: Cast-in-place concrete.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified.
 - 1. National Electrical Manufacturer's Association (NEMA):
 - NEMA WD-1; General-Purpose Wiring Devices.
 - NEMA WD-2; Semiconductor Dimmers for Incandescent Lamps.
 - NEMA WD-5; Specific-Purpose Wiring Devices.
 - NEMA SSL 7A; Phase-Cut Dimming for Solid State Lighting
 - 2. Underwriter's Laboratories (UL):
 - UL 20 General-Use Snap Switches.
 - UL 231; Power Outlets.
 - UL 310; Electrical Quick-Connect Terminals.
 - UL 498; Attachment Plugs and Receptacles.
 - UL 514A; Metallic Outlet Boxes.
 - UL 514D; Cover Plates for Flush-Mounted Wiring Devices.
 - UL 943; Ground-Fault Circuit-Interruptioners.
 - UL 1681; Wiring Device Configurations.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 3. Provide color finishes for Architect to select from.
 - 4. Submit Manufacturer's installation instructions.
- B. Where inscribed device coverplates are noted on the Drawings or in the Specifications, conform to the requirements of Section 260553: Electrical Identification.

1.04 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.05 WARRANTY

- A. Occupancy sensors offered under this Section shall be covered by a **1**-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 - 1. Switches, receptacles and coverplates:
 - a. Pass & Seymour.
 - b. Hubbell.
 - c. Leviton.
- B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 WALL SWITCHES

- A. Standards: Provide general-purpose 120/277volt AC switches that conform to NEMA WD-1 Specifications.
- B. Color: Device color shall be as selected by the Architect, unless otherwise noted.
- C. Wall switches:
 - 1. Provide twenty amperes, 120/277volt, Specification grade, toggle handle, quick-make slow-break, quiet type snap switch with silver cadmium alloy contacts, binding head terminal screws, back and side wired with totally enclosed case.

2. Single-pole, single-throw switches: Hubbell #1221 series, Pass & Seymour #20AC1 series or Leviton #1221 series.
3. Three-way switches: Hubbell #1223 series, Pass & Seymour #20AC3 series or Leviton #1223 series.

2.03 RECEPTACLES

A. Standards:

1. Provide general purpose 20amp, 125/250volt AC receptacles that conform to NEMA WD-1 Specifications. Specialty receptacles shall conform to NEMA WD-5 Specifications as applicable.
2. Provide NEMA 5-20R, industrial (heavy-duty) specification grade as noted herein, 20amp, 125volt AC, 2-pole, 3-wire grounding type receptacles.
3. Receptacles shall be the standard conventional style device.
4. Receptacles shall be tamper-resistant to meet the requirements of CEC Article 406.12.

B. Color:

1. Device color shall be as selected by the Architect, unless otherwise noted.
2. Devices connected to an emergency circuit shall be red.

C. General purpose single outlets:

1. Provide self-grounding back and side wired with binding head staked terminal screw.
2. Use Hubbell #5361 series, Pass & Seymour #5361 series Leviton #5361 series.

D. General purpose duplex receptacles:

1. Provide self-grounding, back and side wired with binding head staked terminal screws and break-off strip for two-circuit wiring.
2. Use Hubbell #5362 series, Pass & Seymour #5362 series or Leviton #5362 series.

E. Ground fault circuit interrupting (GFCI) receptacles:

1. Provide 20amp, 125volt AC, receptacles consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5-milli-amp line-to-ground fault current in approximately 1/40th of a second.
2. Provide visual device with trip indication, manual reset, and test mechanisms and with point of use and multi-outlet protection.
3. Provide self-test and monitor feature with visual indicators on device face representing power status, trip condition, ground fault condition and end of life status.
4. Provide weather resistant devices at all damp and wet locations.
5. Use Pass & Seymour #2097TR series, Hubbell GFTRST20 series, Leviton #S7899 series, for Specification grade GFCI receptacles.
6. Use Pass & Seymour #2097TRWR series, Hubbell GFTWRST20 series, Leviton #WT899 series for weather resistant GFCI receptacles.

F. Special purpose receptacles: Provide Specification grade devices with the NEMA configuration, voltage and current rating, number of poles and ground provisions as noted on the Drawings.

2.04 COVERPLATES

A. General:

1. Provide all coverplates with rounded edges and corners, smooth and free of grooves, embossing or other embellishment.
2. Provide mounting screws to match the plate finish.
3. Provide gang type coverplates where two or more devices are installed at one location. Individual gangable coverplates are not acceptable.
4. Provide plates of one design, standard conventional designer decora style, throughout the Project unless otherwise specified.

B. Color: Coverplate color shall be white as specified by the Architect, unless otherwise noted.

C. Plastic coverplates:

1. Provide smooth, high impact, self-extinguishing thermoplastic coverplates and 0.100 inches thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.

D. Metal coverplates:

1. Provide smooth, type 430 stainless steel coverplates, 0.035" thick with rounded edges and corners.
2. Provide openings to accommodate the devices indicated on the Drawings and in the Specifications.
3. Provide removable plastic film to protect coverplates during installation. Remove film at time of final acceptance.

E. Weatherproof coverplates:

1. Provide horizontal mounted weatherproof in-use coverplate for one duplex or one GFCI receptacle. Provide gasketed, spring loaded, lockable, vertically self-closing covers suitable for use in damp and wet locations as described in UL 514 and CEC 406. Covers shall allow the use of the device with the cover closed.
2. Furnish base plates, covers, hinge pins, spring and screws of corrosion resistant type 302 stainless steel.
3. Provide two (2) keys for each locking type coverplate.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of wiring device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Coordinate device heights in vending, kitchen and utility areas with benches and counters.

- B. Coordinate switch mounting location with Architectural details. Unless otherwise noted, locate switches on latch side of door.

3.03 INSTALLATION

- A. Install wiring devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Install devices with the vertical centerline plumb and with all edges of the device flush against the adjacent wall surfaces.
- C. Mount switches at 42 inches to center above finished floor unless otherwise noted.
- D. Mount receptacles vertically with the centerline 18-inches above finished floor and with grounding slot at bottom.
- E. Mount receptacles vertically when mounting above counters, mount with grounding slot to the left.
- F. Mount GFCI receptacles in the following locations, whether indicated as GFCI type or not on the drawings:
 - 1. Outdoors.
- G. Provide coverplates for all outlet boxes, switches, receptacles, etc.
- H. Install blank coverplates on all outlet boxes in which no device is required or installed.
- I. Provide coverplates that completely cover wall opening and seat against wall.

3.04 FIELD QUALITY CONTROL

- A. Electrical testing:
 - 1. Test proper polarity of all receptacles.
 - 2. Test ground continuity of all wiring devices.
 - 3. Test ground fault interrupting device operation.
- B. Visual and mechanical inspection:
 - 1. Check proper operation of all switches.
 - 2. Visually inspect and replace damaged or defective devices.

3.05 CLEANING

- A. Clean interior of all boxes from dirt and paint prior to installation of devices.
- B. Clean wiring devices and coverplates from dirt and paint over spray.

END OF SECTION

SECTION 26 28 16

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Molded case circuit breakers.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and standards except as otherwise indicated or specified:
 - 1. Underwriters Laboratories, Inc. (UL):
 - UL 248(1-16); Low-Voltage Fuses.
 - UL 489; Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
 - UL 512; Fuseholders.
 - 2. National Electrical Manufacturer Association (NEMA):
 - NEMA AB 1; Molded Case Circuit Breakers.

1.03 SUBMITTALS

- A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:
 - 1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - 2. Describe product operation, equipment and dimensions and indicate features of each component.
 - 3. Clearly mark on each data sheet the specific item(s) being submitted and the proposed application.
 - 4. Provide factory certification of trip characteristics for each type and rating of circuit breaker.
 - 5. Provide current let-through and melting time information for each type and rating of fuses.
 - 6. Confirmation in writing of compliance with Arc Energy Reduction per CEC Articles 240.67 and 240.87.
 - 7. Submit Manufacturer's installation instructions.

8. Complete bill of material listing all components.

9. Warranty.

1.04 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. A detailed explanation of the operation of the system.
2. Instructions for routine maintenance.
3. Parts list and part numbers.
4. Telephone numbers for authorized parts and service distributors.
5. Final testing reports.

1.05 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Overcurrent Protective Device components shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.07 WARRANTY

- A. Units and components offered under this Section shall be covered by a **1**-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
1. Circuit breakers:
 - a. Square D.
 - b. ABB/ General Electric.

- c. Eaton.
- d. Siemens.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

- A. Overcurrent protective devices shall satisfy all CEC mandated selective coordination requirements (e.g. CEC Articles 517, 620, 645, 695, 700, 701, 708).
- B. Fuses rated 1200 amps or higher shall satisfy CEC Article 240.67 requirements.
- C. Circuit breakers rated (or can be adjusted) 1200amps or higher shall satisfy CEC Article 240.87 requirements.

2.03 MOLDED CASE CIRCUIT BREAKERS

- A. Branch and feeder circuit breakers shall be molded case, bolt on and trip indicating.
- B. Where stationary molded case circuit breakers are indicated on the Drawings to be current limiting type, they shall be current limiting as defined by UL 489 and shall not employ any fusible elements.
- C. Circuit breakers shall have interrupting capacity not less than that indicated on the Drawings or if not indicated, not less than 14,000 RMS symmetrical amps for 480volt systems and 10,000 RMS symmetrical amps for 208volt systems.
- D. Covers shall be sealed on non-interchangeable breakers and trip unit covers shall be sealed on interchangeable trip breakers to prevent tampering. Circuit breaker ratings shall be clearly visible after installation or engraved nameplates shall be provided stating the rating. All ferrous parts shall be plated to minimize corrosion.
- E. Circuit breakers shall be toggle, quick-make and quick-break operating mechanisms with trip-free feature to prevent contacts being held closed against overcurrent conditions in the circuit. Trip position of the breakers shall be clearly indicated by operating handles moving to a center position.
- F. Provide identified handle ties for single pole circuit breakers that share a neutral conductor.
- G. Multipole breakers shall have a single handle to open and close all contacts simultaneously in both manual operation and under automatic tripping. Interpole barriers shall be provided inside the breaker to prevent any phase-to-phase flashover. Each pole of the breaker shall have means for Arc extinguishing.
- H. All terminals shall be dual rated for aluminum or copper wire.
- I. Circuit breakers with frame ratings 100amps and smaller shall be ambient temperature compensated, thermal magnetic type unless otherwise noted. Breakers shall be of full size, 1" per pole type. Panels with more than one branch breaker larger than 100amps shall be installed in distribution type panels.
- J. Circuit breakers with frame ratings above 100amps through 400amps shall have solid state electronic trips with true RMS reading through the 13th harmonic with 1% accuracy, interchangeable trip via front accessible current plug, adjustable instantaneous and short time be rated as indicated on Drawings at the voltage indicated.
- K. Circuit breakers with frame ratings above 400amps through 2500amps shall have microprocessor-based RMS sensing trip units with the following characteristics:

1. Interchangeable current rating plug or an adjustable trip setting to match the trip rating as indicated on Drawings.
 2. Adjustable long-time pick-up setting. Minimum of five settings from 50% to 100%.
 3. Adjustable long-time delay setting. Minimum of three delay bands.
 4. Adjustable short time pick-up setting. Minimum of five settings from 200% to 800%.
 5. Adjustable short-time delay setting. Minimum of three delay bands with I2t IN and OUT curves.
 6. Adjustable instantaneous pick-up setting. Minimum of five settings from 200% to 1000%. Where the instantaneous feature is omitted on the Drawings, the trip unit shall have an instantaneous override feature.
 7. Zone selective interlocking (ZSI) for short-time delay and ground-fault delay trip functions, if indicated on the drawings.
 8. LED status indication to show "health" of trip unit.
 9. Three-phase ammeter, if indicated on the drawings.
 10. Trip indication targets on overload, ground fault and short circuit, if indicated on the drawings.
- L. Accessories: Provide accessories as noted on the Drawings, i.e. shunt-trip, auxiliary contacts, undervoltage trip, alarm switch, etc.
- M. Spaces in the boards shall be able to accept any combination of 1, 2 or 3-pole circuit breakers as indicated. Provide all necessary bus, device supports, and mounting hardware sized for frame, not trip rating.
- N. Series rated breakers are not acceptable unless specifically noted on the Drawings.
- O. Breaker shall be rated to operate in an ambient temperature of 40-degrees C and at 100% of their frame ampere rating on a continuous basis, if indicated on the drawings.
- P. For circuit breakers rated or can be adjusted to 1200amps (or higher), provide zone selective interlocking (ZSI) with downstream protective devices, if indicated on the drawings. If ZSI is not indicated on the drawings, provide a key interlock maintenance mode switch and blue LED indicating lamp in the same section, which shall allow an operator to manually enable temporary protective device maintenance settings to reduce the arc flash energy level. Key shall be held captive when maintenance mode signal is disabled and removable when maintenance mode signal is enabled. Maintenance mode switch positions shall be labeled "Enabled" and "Disabled". Blue indicating lamp shall be push-to-test type.
- Q. Refer to the Drawings for breakers requiring ground fault protection. See Section 262413: Switchboards for requirements of ground fault protection system.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of overcurrent protective device installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 INSTALLATION

- A. Install overcurrent protective devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Tighten electrical connectors and terminals; including screws and bolts, in accordance with equipment Manufacturers published torque-tightening values for equipment connectors. Where Manufacturers torque requirements are not indicated tighten connectors and terminals to comply with tightening torque specified in UL Standard 486A.
- C. Install overcurrent protective devices and accessories in accordance with Manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. All devices shall be installed in accordance with applicable CEC and NEMA standards for installation.

3.03 FIELD QUALITY CONTROL

- A. Independent testing: Contractor shall arrange and pay for the services of an independent Testing Agency to perform all quality control electrical testing, calibration and inspection required herein. Testing Agencies objectives shall be to:
 - 1. Assure overcurrent protective device installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test and inspect to ensure operation in accordance with Manufacturer's recommendations and Specifications.
 - 3. Prepare final test report including results, observations, failures, adjustments, and remedies.
 - 4. Verify ratings and settings and make final adjustments.
- B. At least three weeks prior to any testing, notify the Engineer so that arrangement can be made for witnessing test, if deemed necessary. All pretesting shall have been tested satisfactorily prior to the Engineer's witnessed test.
- C. The Contractor shall supply a suitable and stable source of electrical power to each test site. The Testing Agency shall specify the specific power requirements.
- D. Testing of overcurrent protective devices shall be done only after all devices are installed and prior to system being energized.
- E. Prefunctional testing:
 - 1. Provide Testing Agency with Contract Documents and Manufacturer instructions for installation and testing.
 - 2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with Manufacturer's instructions.
 - c. Compare nameplate information and connections to Contract Documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers, and doors are secure.
 - 3. Electrical tests:
 - a. Circuit continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.

- b. Test all circuit breakers with frame size 225amps and larger in each panelboard, distribution board, switchboard, etc. unless otherwise noted via primary current injection testing. Testing shall verify the following:

- 1) Determine that circuit breaker will trip under overcurrent conditions, with tripping time in conformance with NEMA AB 1 requirements.
- 2) Circuit breaker pickup and delay measurements are within the manufacturers published tolerances for long time, short time, instantaneous, and ground fault.
- 3) For circuit breakers rated or can be adjusted to 1200amps (or higher), confirm ZSI protection is acceptable or the maintenance mode switch is operational (enabled and disabled) with reduced pickup and delay measurements when enabled.

- F. Contractor shall replace at no costs to the Owner all devices which are found defective or do not operate within factory specified tolerances.
- G. Contractor shall submit the Testing Agency's final report for review prior to Project closeout and final acceptance by the Owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies, and remedies. Test report shall be included in the operation and maintenance manuals.

3.04 ADJUSTING

- A. Adjust circuit breaker trip settings for coordination with other overcurrent protective devices in system.
- B. Adjust circuit breaker trip settings for adequate protection from overcurrent and fault currents.

3.05 CLEANING

- A. Upon completion of Project prior to final acceptance the Contractor shall thoroughly clean overcurrent protective devices per Manufacturer's approved methods and materials. Remove paint splatters and other spots, dirt, and debris.

3.06 TRAINING

- A. Contractor shall schedule training with a minimum of 7-days advance notice.

END OF SECTION

SECTION 26 50 00

LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included: Labor, materials, and equipment necessary to complete the installation required for the item specified under this Division, including but not limited to:
 - 1. Exterior luminaires.
 - 2. Light-emitting diode (LED) assemblies.
 - 3. Drivers and transformers.
 - 4. Optical components; including diffusers, refractors, reflectors, and louvers.
 - 5. Poles and brackets.
- B. Related Work: Consult all other Sections, determine the extent and character of related Work, and properly coordinate Work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

- A. Comply with the latest edition of the following applicable Specifications and Standards except as otherwise indicated or specified:
 - 1. American National Standards Institute (ANSI):
 - ANSI/IEC 60529; American National Standard for Degrees of Protection Provided by Enclosures (IP Code)
 - C137.0 Lighting System Terms and Definitions.
 - C137.1 0-10V Dimming Interface for LED Drivers and Controls
 - 2. Underwriters Laboratories, Inc. (UL):
 - UL 66; Fixture Wire.
 - UL 102.3; Standard Method of Fire Test of Light Diffusers and Lenses.
 - UL 1598; Luminaires.
 - UL 1598C; Light-Emitting Diode Retrofit Luminaire Conversion Kits.
 - UL 1838; Low Voltage Landscape Lighting Systems.
 - UL 1993; Self-Ballasted Lamps and Lamp Adapters.
 - UL 2007A; Shatter Containment of Lamps for Use in Regulated Food Establishments.
 - UL 2108; Low Voltage Lighting Systems.
 - UL 2592; Low Voltage LED Wire.
 - UL 5085-3; Low Voltage Transformers: Class 2.
 - UL 8750; Light Emitting Diode (LED) Equipment for Use in Lighting Products.

- UL 8753; Field-Replaceable Light Emitting Diode (LED) Light Engines.
- UL 8754; Holders, Bases, and Connectors for Solid-State (LED) Light Engines and Arrays.

3. National Electrical Manufacturers Associations (NEMA):

- SSL-1; Electronic Drivers for LED Devices, Arrays or Systems.
- SSL-4; Retrofit Lamps—Minimum Performance Requirements.
- 77; Temporal Light Artifacts: Test Methods and Guidance for Acceptance Criteria.
- LE-4; Recessed Luminaires, Ceiling Compatibility
- 100; Wire Insulation Colors for Lighting Systems

4. Illuminating Engineering Society of North America (IESNA):

- TM-15; Luminaire Classification System for Outdoor Luminaires.
- TM-21; Projecting Long Term Lumen Maintenance of LED Light Sources.
- TM-30; Method for Evaluating Light Source Color Rendition.
- TM-30-Annex E Recommendations for Specifying Light Source Color Rendition
- LM-79; Electrical and Photometric Measurements of Solid-State Lighting Products.
- LM-80; Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
- LM-84; Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires.
- LM-86; Measuring Luminous Flux and Color Maintenance of Remote Phosphor Components

5. Restriction of Hazardous Substances (RoHS):

- RoHS 3; Directive 2015/863 - Cat 5. Lighting: lamps, luminaires, light bulbs.

1.03 SYSTEM DESCRIPTION

- A. Provide and install a fully functional and operating lighting system as indicated, complete with light engines, lamps, wiring, and securely attached to support system to meet all seismic code requirements.
- B. Where catalog number and narrative or pictorial descriptions are provided, the written description shall take precedence and prevail.

1.04 SUBSTITUTIONS

- A. Refer to Section 260010: Basic Electrical Requirements for specific Equipment requirements.
- B. Items specified under this Section and Luminaire Schedule are subject to the requirements, with the following qualifications:
 - 1. Items solely specified by Manufacturer name and catalog number, without qualifiers: Provide as specified – No Substitutions.

2. Items specified by multiple Manufacturers, without qualifiers: Provide any listed manufacturer – No Substitutions.
 3. Items specified by sole or multiple Manufacturers, followed by “Or Approved Equal” or “Or Approved Equivalent”: Conform to substitution requirements outlined for Equipment.
 4. Items specified by sole or multiple Manufacturers, followed by “Or Equal” or “Or Equivalent”: Products that meet the salient requirements are acceptable to provide.
 - a. Equivalency is at the sole judgement of the Architect and Engineer.
 - b. Should a submitted, unspecified product fail to meet the requirements of Equivalency, provide specified products at no additional cost to the Owner.
- C. Equivalency shall be determined by review of the following luminaire characteristics where applicable. Lack of pertinent data on any characteristic shall constitute justification for rejection of the submittal or substitution.
1. Performance:
 - a. Distribution.
 - b. Utilization.
 - c. Luminance distribution (Average brightness / maximum brightness.)
 - d. Spacing to mounting height ratio.
 - e. Overall luminaire efficiency.
 2. Construction:
 - a. Engineering.
 - b. Workmanship.
 - c. Rigidity.
 - d. Permanence of materials and finishes.
 3. Installation Ease:
 - a. Captive parts and captive hardware.
 - b. Provision for leveling.
 - c. Through-wiring ease.
 4. Maintenance:
 - a. Ease of relamping / replacement of LED array.
 - b. Ease of replacement of driver/ballast and lamp sockets.
 5. Appearance:
 - a. Architectural integration.
 - b. Light tightness.
 - c. Styling.
 - d. Conformance with design intent.

- e. When requested, furnish a working sample complete with housing, trim, 8' cord and plug, and specified lamp.

1.05 SUBMITTALS

A. Submit in accordance with the requirements of Section 260010: Basic Electrical Requirements, the following items:

1. Complete bill of material listing (index) of all luminaires. Index shall be organized in the same sequence as the Luminaire Schedule (alphabetical.) Include in the index:
 - a. Type per the Luminaire Schedule.
 - b. Manufacturer.
 - c. Complete catalog number, including all accessories and appurtenances required for the installation.
 - d. Voltage.
 - e. Poles, arms, and brackets, if applicable.
 - f. Lamping, if applicable.
2. Manufacturer's data sheets/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards.
 - a. Identify luminaire type on each sheet.
 - b. Clearly mark on each data sheet the specific item(s) being submitted. Obfuscate or otherwise delete options on data sheets that are not provided.
3. Driver or transformer and/or lamp data sheets as applicable to submitted item.
4. Manufacturer's installation instructions.
5. Warranty.
6. U.L. labeling information.
7. Photometric Reports consisting of:
 - a. Independent Testing Laboratories, Inc. or equal, photometric test report for each luminaire listed on the Luminaire Schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain candlepower distribution curves in five lateral planes for luminaires with asymmetric distributions and luminance data for vertical angles above 45 degrees from nadir.
 - b. Coefficient of utilization table.
 - c. Zonal lumen summary including overall luminaire efficiency.

1.06 OPERATION AND MAINTENANCE MANUAL

A. Supply operation and maintenance manuals in accordance with the requirements of Section 260010: Basic Electrical Requirements, to include the following:

1. An updated index per 1.05-A.
2. One complete set of final submittals of actual product installed, including product data and shop drawings.

3. Instructions for routine maintenance.
4. Pictorial parts list and parts number.
5. Telephone numbers for authorized parts and service distributors.

1.07 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new, unused, and currently under production.
- B. Only products and applications listed in this Section may be used on the Project unless otherwise submitted.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Luminaires shall not be delivered to the Project site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to Manufacturer at no cost to Owner.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with Manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to Manufacturer.

1.09 WARRANTY

- A. Units and components offered under this Section shall be covered by a **1**-year parts and labor warranty for malfunctions resulting from defects in materials and workmanship. Warranty shall begin upon acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Products furnished by the following Manufacturers shall be acceptable if in compliance with all features specified herein and indicated on the Drawings.
 1. Luminaires, Poles, and Exit Signs: as listed in the Luminaire Schedule.
 2. Light-Emitting Diode (LED) Arrays:
 - a. Cree.
 - b. Nichia.
 - c. Citizen.
 - d. Lumileds.
 - e. Samsung.
 - f. Lumenetix Araya.
 - g. Xicato.
 - h. Bridgelux.
 - i. LEDs provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

3. LED drivers (DC output):
 - a. eldoLED.
 - b. Lutron.
 - c. Signify Advance.
 - d. Osram.
 - e. Q-Tran.
 - f. Universal Lighting Technologies.
 - g. Drivers provided by Luminaire Manufacturer listed in the Luminaire Schedule: meeting the technical and warranty requirements of this Section.

B. Substitutions: Under provisions of Section 260010: Basic Electrical Requirements.

2.02 GENERAL

- A. Luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.
- B. Luminaire assemblies U.L. listed appropriate to mounting conditions and application. All labels affixed to the luminaire shall be in a location not visible from normal viewing angles.
- C. Each luminaire family type (downlights, etc.) supplied by only one manufacturer.
- D. Luminaires installed in damp or wet locations shall be UL listed and labeled as suitable for damp or wet locations.
- E. Luminaires shall bear the IP rating appropriate for the application.
- F. Luminaires shall be free of light leaks and shall be designed to provide sufficient ventilation of light engines, including ventilation holes where required.

2.03 LUMINAIRE CONSTRUCTION

- A. All sheet metal Work shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. 20-gauge (0.7-mm or 0.027-inch) minimum.
 1. Finish: Baked white dry polyester powder, unless otherwise specified, with a minimum average reflectance of 85% on all exposed and light reflecting surfaces. Steel components shall be prepared for finishing with a 5-step zinc phosphating process prior to painting.
 2. Luminaire (including all painted component parts) shall be painted after fabrication unless specifically noted in the Luminaire Schedule.
- B. Extruded Aluminum Housings: One-piece housing of AA 6063 T5 extruded aluminum with 0.14 minimum thickness smooth and free of tooling lines in one uninterrupted section of 1-foot to 24-foot with the cross sectional dimensions as indicated in the Luminaire Schedule.
- C. Die-Cast Aluminum Housings:
 1. Single-piece casting to ensure water tightness.
 2. Low copper (<0.7% Cu) aluminum alloy.
 3. Minimum Class 4 Consumer Grade per NADCA Standards.
- D. All surfaces shall be cleaned and dressed to eliminate all exposed sharp edges or burrs.

- E. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly.
- F. End Plates: Die cast end plates shall be mechanically attached without exposed fasteners. End caps shall be minimum 0.125" thick.
- G. All mitered corners or joints shall be accurately aligned with abutting intersecting members. Sheet metal Work shall be properly fabricated so that planes will not deform (i.e. become concave or convex) due to normal expected ambient and operating conditions.
- H. Ferrous mounting hardware and accessories shall be finished using either a galvanic or phosphate primer/baked enamel process to prevent corrosion and discoloration of adjacent materials.
- I. Fasteners shall be manufactured of galvanized steel.
- J. Adjustable Lamp Mechanisms: To have aiming stops which can be permanently set to position lamp vertically and rotationally.
- K. Finish:
 - 1. All exposed aluminum surfaces shall be treated with an acid wash and clear water rinse prior to painting. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.
 - 2. All exposed steel surfaces shall be treated with an acid wash and clear water rinse, then prime coated. The luminaire shall then be electrostatically painted, or powder coated, and oven baked in the color indicated in the Luminaire Schedule.
- L. Door Frames for lensed luminaires: White painted, flat aluminum with mitered corners.

2.04 LAMP HOLDERS

- A. Of configuration and design to accept standard lamp bases.
- B. Wiring channels and lampholder mountings shall be rigid and accurately constructed.
- C. Integral-driver LED:
 - 1. Medium screw base: Unglazed porcelain body or thermoplastic (PET GF) with copper-alloy screw shell. 660watt, 250volt rated.
 - 2. Bi-Pin base: Ceramic casing with mica cover plate, copper allow contact surfaces. Pin distance designed for lamp provided.

2.05 LED ARRAYS

- A. Minimum lumen maintenance per LM-80 measurements and TM-21 calculations: L90 at 60,000 hours.
- B. Maximum burnout: B90 at 200,000-hours.
- C. Free of mercury and toxic materials; RoHS compliant.
- D. Linear LED boards: LED pitch shall be consistent throughout the luminaire and shall remain consistent from the end of one board to the start of the next. LED pitch shall be the same from the endcap of the luminaire to the last LED on the board as the LED pitch throughout the luminaire. Luminaire shall have a continuous luminous appearance – bright or dark spots are not acceptable.
- E. White LEDs:
 - 1. Interior

- a. Correlated Color Temperature (CCT): 4000K
 - b. Minimum efficacy: 75 lumens per watt.
 - c. L70 lifetime: minimum 80,000-hours (extrapolated.)
 - d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 3-step MacAdam ellipse variation throughout listed life (L70).
 - e. Color Rendering Index (CRI); minimum 80 Ra.
 - f. R9 value; minimum 30.
 - g. TM30 values; $R_f > 75$, $92 > R_g > 110$.
2. Exterior
- a. Correlated Color Temperature (CCT): 4000K
 - b. Minimum efficacy: 100 lumens per watt.
 - c. L70 lifetime: minimum 100,000-hours (extrapolated.)
 - d. Correlated Color Temperature (CCT); as specified in Luminaire Schedule. Maximum 4-step MacAdam ellipse variation throughout listed life (L70).
 - e. Color Rendering Index (CRI); minimum 70 Ra.
 - f. R9 value; minimum 20.
 - g. TM30 values; $R_f > 70$, $80 > R_g > 120$.

2.06 LED DRIVERS:

- A. LED drivers shall be integral to luminaire housing or remotely located, when specified, within 15 feet of diode assembly.
 1. Luminaires shall be provided with the UL listed or equivalent driver and low voltage power supply as recommended by Manufacturer to insure proper and consistent lamp and luminaire performance. The number of LEDs per luminaire per power supply shall not be exceeded, and LEDs shall not be wired to a high capacity driver unless recommended by Manufacturer.
 2. Light Emitting Diode (LED) control gears shall operate with sustained variations of +/- 10% in voltage and frequency without damage to the driver and have a power factor not less than 90%. Regulations: +/-5% across the listed load range.
 3. Driver input current shall have Total Harmonic Distortion (THD) of less than 20%. The Driver shall have a Class A sound rating unless otherwise specified.
 4. Control gear shall be rated for 50-degree C ambient temperature.
 5. All control gear shall facilitate smooth, flicker-free dimming from 100% to 10%, 1% or 0.1% as noted on the Luminaire Schedule.

2.07 POLES

- A. Wind-load strength: 80 mph and 1.3 gust factor for total support assembly, including pole, base and anchorage, where used, to carry the combined Effective Projected Area (EPA) rating of the luminaire heads, arms, supports, and appurtenances at the indicated heights above grade without deflection or whipping.
- B. Pole shafts:

1. Round straight, round tapered, square straight, or square tapered as noted on the Luminaire Schedule.
 2. Steel poles: Steel tubing conforming to ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psi. Single piece construction up to 40-feet in height.
- C. Arm, bracket and tenon mount materials: Finish to match poles.
 - D. Mountings, fastenings, and appurtenances: Corrosion-resistant components compatible with the poles and luminaires that will not cause galvanic action at contact points. Provide mountings that will correctly position the luminaire to provide the indicated light distribution.
 - E. Handhole: Provide handhole and cover near base of pole shaft for access to wiring compartment.
 - F. Grounding lug: Provide grounding lug for grounding conductor with access through handhole.
 - G. Pole bases: Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts and bolt covers.
 - H. Anchor bolt covers: Spun or two-piece gravity held unless otherwise specified.
 - I. Pole-top tenons: Fabricated to support the luminaire indicated and securely fastened to the pole top.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contractor shall thoroughly examine Project site conditions for acceptance of luminaire installation to verify conformance with Manufacturer and Specification tolerances. Do not commence with installation until all conditions are made satisfactory.

3.02 PREPARATION

- A. Architectural Plans shall govern exact ceiling construction and mounting conditions for all luminaires. Locate as shown on the architectural elevations and reflected ceiling plan.
- B. Consult Architectural Drawings for details of ceiling construction, finish, and other applicable details.
- C. Contractor shall be responsible for coordination of luminaire mounting and compatibility with ceiling construction.

3.03 INSTALLATION

- A. Install luminaires in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.
- B. Contractor shall be responsible for all supports, hangers, and hardware necessary for a complete installation.
- C. Luminaires shall be plumb, level, square, in straight lines and without distortion.
- D. Remedy light leaks that may develop after installation of recessed or enclosed luminaires.

3.04 INSTALLATION OF POLES

- A. General: Store poles on decay-resistant treated skids at least 1-foot above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.
- B. Metal poles: Retain factory-applied pole wrappings until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

- C. Wood poles: Do not drag treated poles along the ground. Do not handle poles with tongs, cant hooks and other pointed tools capable of producing indentation more than ¼-inch in depth. Do not apply tools to ground line section of poles.
- D. Pole installation: Use fabric web slings (not chain or cable) to raise and set poles.

3.05 CONCRETE FOUNDATIONS

- A. Construct concrete foundations conforming to Division 03, Section "Cast-In-Place Concrete."
- B. Utilize manufacturer's bolt templates to properly position anchor bolts.
- C. Provide leveling nut to anchor bolt prior to pole base. After pole leveling, pack non-shrink grout between pole base and concrete foundation.
- D. Comply with details and Manufacturer's recommendations for reinforcing, anchor bolts, nuts and washers.

3.06 FIELD QUALITY CONTROL

- A. Visual and mechanical inspection:
 - 1. Inspect for physical damage, defects, alignment and fit.
 - 2. Perform operational test of each luminaire after installed, circuited, and energized.
 - 3. Perform emergency operational test of all luminaires connected to emergency circuiting by simulating normal power source failure.
- B. Contractor shall replace at no cost to the Owner all equipment which is found defective or do not operate within factory specified tolerances.

3.07 CLEANING

- A. Clean luminaires prior to Project closeout in accordance with Manufacturer's recommended materials and methods.
- B. Remove all debris, fingerprints, and packaging remnants.

END OF SECTION

SECTION 27 00 00

COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies the common administration basic requirements and common methods for all low voltage systems installation work included under Division 27 and 28 and where those requirements differ from the requirements of this section, the more stringent shall govern.

1.02 STANDARDS, REGULATIONS, AND CODES REFERENCES

- A. The following Standards, Regulations and Codes apply to work specified in the Contract Documents.
1. Applicable State and Local Codes.
 2. California Building Code and California Electrical Code, Current Editions.
 3. BICSI TDMM (Telecommunications Distribution Methods Manual), 11th Edition 2006.
 4. ANSI/TIA/EIA-568-B.1. Commercial Building Telecommunications Cabling Standard,
 5. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 2, Grounding and Bonding Specifications for Screened Balanced Twisted-Pair Horizontal Cabling.
 6. ANSI/TIA/EIA-568-B.1-3. Commercial Building Telecommunications Cabling Standard.
 7. ANSI/TIA/EIA-568-B.1-4. Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements, Addendum 4, Recognition of Category 6 and Category Cat 6A and 50 nm Laser-Optimized 50/125 um Multimode Optical Fiber Cabling.
 8. ANSI/TIA/EIA-568-B.1-2. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
 9. ANSI/TIA/EIA-568-B.2-1. Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 1, Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.
 10. ANSI/TIA/EIA-568-B.2-10 (draft 2.0). Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components, Addendum 10, Transmission Performance Specifications for 4-Pair 100 Ohm Augmented Category 6 Cabling.
 11. ANSI/TIA/EIA-568-B3.3 Optical Fiber Cabling Components Standard.
 12. TIA-569-B. Commercial Building Standard for Telecommunications Pathways and Spaces.
 13. ANSI/TIA/EIA-606-A. Administration Standard for Commercial Telecommunications Infrastructure.
 14. ANSI/TIA/EIA-607-A. Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 15. TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
 16. TIA/EIA TSB-72 Centralized Optical Fiber Cabling Guidelines.

1.03 DEFINITIONS

- A. The following is a list of abbreviations generally used in Divisions 27 & 28:
1. ADA - Americans with Disabilities Act
 2. AHJ - Authority Having Jurisdiction
 3. ANSI - American National Standards Institute
 4. APWA - American Public Works Association
 5. ASTM - American Society for Testing and Materials
 6. CBC - California Building Code
 7. CEC - California Electrical Code
 8. CFC - California Fire Code
 9. FCC - Federal Communications Commission
 10. HVAC - Heating, Ventilating and Air Conditioning
 11. IEC - International Electro-technical Commission
 12. IEEE - Institute of Electrical and Electronics Engineers.
 13. IETA - International Electrical Testing Association
 14. FM - FM Global
 15. NEMA - National Electrical Manufacturers Association
 16. NFPA - National Fire Protection Association
 17. OSHA - Occupational Safety and Health Administration
 18. UL - Underwriters Laboratories Inc.
- B. Provide: To furnish and install, complete and ready for the intended use.
- C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly, and installation.
- D. Install: Includes unloading, unpacking, assembling, erecting, installing, applying, finishing, protecting, cleaning and similar operations at the project site to complete items of work furnished by others.
- E. Following is a list of commonly used terms in Division 27:
1. Active Equipment: Electronic equipment used to develop various WAN and LAN services.
 2. Backbone: Collective term sometimes used to describe the campus and vertical distribution subsystem facilities and media interconnecting service entrances, communications rooms, and communications cabinets.
 3. Bonding: Permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to safely conduct currents likely to be imposed on it.
 4. Cabinet: Wall-mounted modular enclosure designed to house and protect wall electronic equipment.
 5. Cable Tray: Vertical or horizontal open supports, usually made of aluminum or steel, that are fastened to a building ceiling or wall. Cables are laid in and fastened to the trays. A cable tray is not a raceway.
 6. Campus: Grounds and buildings of a multi-building premises environment.
 7. Channel: The end-to-end transmission path between two points at which application specific equipment is connected; may include one or more links, cross-connect jumper and/or patch cords, and work area station cords. Does not include connection to active equipment.

8. Cross-Connect: Equipment used to terminate and tie together communications circuits.
9. Cross-Connect Jumper: A cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.
10. Fiber Optic Distribution Unit (FDU): Cabinet with terminating equipment used to develop fiber optic cross-connect facilities. Also known as LIU.
11. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
12. Hinged Cover Enclosure: Wall-mounted box with a hinged cover that is used to house and protect electrical devices.
13. Horizontal: Pathway facilities and media connecting communications rooms to Telecommunications Outlets.
14. Intermediate Distribution Frame (IDF): Data networking equipment rack and/or location that serves individual buildings. Downstream from MDF.
15. Jack: Receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.
16. Link: A transmission path between two points, not including terminal equipment, work area cables, and equipment cables; one continuous section of conductors or fiber, including the connecting hardware at each end.
17. Local Area Network (LAN): Data transmission facility connecting several communicating devices, e.g., serial data, Ethernet, token ring, etc. Typically, the network is limited to a single site.
18. Main Distribution Frame (MDF): Initial (main) data network equipment rack and/or location. Only one MDF occurs per site and may serve many downstream IDFs.
19. Media: Twisted-pair, coaxial, and fiber optic cable or cables used to provide signal transmission paths.
20. Minimum Point of Entry (MPOE): The location where the service provider hands off connection and responsibility for service to on premise customer owned equipment.
21. Modular plug: For Cat6A an eight-position end-of-wire electrical connector.
22. Passive Equipment: Non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, wiring blocks, FDUs, etc.
23. Patch Cord: A length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross-connect.
24. Patch Panel: System of terminal blocks or connectors used with patch cords that facilitate the administration of cross-connect fields.
25. Pathway: Facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, underfloor systems, raised floor, ceiling support wires, etc.
26. Protectors: Electrical protection devices used to limit foreign voltages on metallic communications circuits.
27. Raceway: An enclosed channel designed expressly for holding wires or cables; may either conductive metal or insulating plastic. The term includes conduit, tubing, wireway, underfloor raceway, and surface raceway; does not include cable tray.
28. Racks: An open or enclosed, freestanding, floor-mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.
29. Wiring Block: Punch down terminating equipment used to develop twisted pair cross-connect facilities.

1.04 PRODUCT AVAILABILITY

- A. Products with long lead times are to be brought to the attention of the project manager.

1.05 PRODUCT SUBMITTALS

- A. See Division 01 Submittals for more requirements

1.06 SUBSTITUTION LIMITATIONS

- A. Equivalent product(s) may be considered for substitution for those products specified, however, the equivalent product(s) must be approved, and show demonstrated and documented equivalence to the product(s) specified. Documentation includes but is not limited to product samples, data sheets, and actual test data. The request for product substitution, and supporting documentation, must be submitted, in writing.
- B. See Division 01 Substitutions for more requirements

1.07 QUALITY ASSURANCE

- A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
- B. Conform to the latest adopted version of the CBC with amendments by local AHJs.
- C. Obtain and pay for electrical permits, plan review, and inspections from local AHJs.
- D. Furnish products listed by UL or other testing firm acceptable to AHJ.
- E. Conform to requirements of the serving electric, telephone, and cable television utilities.
- F. Contractor Qualifications:
 - 1. Minimum of five years' experience in the design, installation, testing, and maintenance of low-voltage systems.
 - 2. Maintain a local service facility which stocks spare devices and/or components for servicing systems.
 - 3. Have performed successful installation and maintenance of at least three projects similar in scope and size. Be able to provide project references for these three projects, including scope of Work, project type, owner/user contact name and telephone number.
 - 4. The contractor selected for this project must be certified by the manufacturer of the products and utilize these components for completion of work.
 - 5. Holds and maintains a valid California C-7 or C-10 State Contractors License and can exhibit validity upon request.

6. A list of test equipment proposed for use in verifying the installed integrity of copper and fiber optic cable systems used.
7. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who will be assigned to this project.
8. A list of technical product training attended by the contractor's personnel that will install the specified manufacturer system.
9. List of Sub-Contractor(s) who will assist the contractor in the performance of this work.

1.08 SEQUENCING AND SCHEDULING

- A. For the proper execution of the work, cooperate with other trades and contracts as needed.
- B. To avoid installation conflicts, thoroughly examine the complete set of Contract Documents. Resolve conflicts with Project Manager/Designer prior to installation.
- C. Prior to installation of communications cable to equipment requiring connections, examine the manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that the electrical characteristics detailed in the Contract Documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Project Manager/Designer.

1.09 SHOP DRAWINGS

- A. Shop Drawings: When required by individual Specification Sections, provide shop drawings which include physical characteristics, electrical characteristics, device layout plans, point-to-point wiring diagrams for all connections, and the like. Refer to individual Specification Sections for additional requirements for the shop drawings.

1.10 WARRANTY

- A. Provide an extended manufacturer's warranty on the Backbone and Horizontal Communications systems as specified in other sections of Division 27.

1.11 CLOSE OUT DOCUMENTS

- A. Final coordination drawings, with as-built information added, are to be submitted as record drawings at completion of project.
- B. Record Drawings:
 1. Show changes and deviations from the Construction Drawings. Include written Addendum and change order items.
 2. Show exact routes of cable tray, surface raceway, conduits, and service entrance conduits.
 3. Show the exact location of racks, cabinets, mounting frames and the like.

- C. Operation and Maintenance Documentation: Provide copies of certificates of code authority acceptance, product data, guarantees, warranties, installation guides, maintenance guides and the like.
- D. Inspection and/or testing: Submit testing reports for testing that was performed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide like items from one manufacturer, such as wire/cable, jacks, modular plugs, patch panels, equipment connection cords, wall plates, and the like. See individual sections for detailed information.

2.02 MATERIALS

- A. Provide new electrical materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established. Indicated brand names and catalog numbers are used to establish standards of performance and quality.
- B. Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide plenum rated cable in ceilings that are utilized as air return plenums.
- C. Include special features, finishes, accessories, and other requirements as described in the Contract Documents regardless of the item's listed catalog number.
- D. Provide incidentals not specifically mentioned herein or noted on Drawings, but needed to complete the system, in a safe and satisfactory working condition.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Construction Documents:
 - 1. Drawings are diagrammatic with symbols representing communications equipment, outlets, and wiring.
 - 2. Electrical symbols indicating wiring and equipment shown in the Contract Documents are included in the Contract unless specifically noted otherwise.
 - 3. Examine the entire set of Drawings to avoid conflicts with other systems. Determine exact route and installation of communications wiring and equipment with conditions of construction.

3.02 INSTALLATION

- A. Install communications equipment completely as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of the communications equipment, examine the instructions thoroughly. When requirements of the installation instructions conflict with the Contract Documents, request clarification from Project Manager/Designer prior to proceeding with the installation.
- B. Do not install communications equipment in obvious passages, doorways, or crawl spaces which would impede or block the passage's intended usage.
- C. Do not install communications equipment in locations where it would obviously be subject to damage during normal usage.

3.03 FIELD QUALITY CONTROL

- A. Tests: Conduct tests of equipment and systems to demonstrate compliance with requirements specified in Division 27 & 28. Refer to individual Specification Sections for required tests. Document tests and include in Closeout Documents.

3.04 CLEANING

- A. Remove dirt and debris caused by the execution of the communications work.
- B. Leave the entire communications system installed under this Contract in a clean, dust-free, and proper working order.
- C. Vacuum clean interiors of new and modified electrical signal and communication equipment enclosures.

END OF SECTION

SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section specifies the basic materials and methods for all low voltage pathways installation work included under Division 27 and 28 and where those requirements differ from the requirements of this section, the more stringent shall govern.
- B. This section adds refinements to Division 26 that apply to Communications and extra-low-voltage systems.

1.02 SCOPE

- A. Materials and/or methods for the following.
 - 1. Communication services
 - 2. Grounding
 - 3. Fasteners
 - 4. Hangers and supports
 - 5. Conduits/Backboxes/Raceways
 - 6. Underground
 - 7. Sleeves and penetrations

1.03 SUBMITTALS

- A. Submittals shall be done in accordance with District submittal procedures, see Division 01 Submittals for requirements.

1.04 RELATED REQUIREMENTS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. 26 00 00 – Electrical
- C. 27 00 00 – Communications Basic Requirements

1.05 REFERENCES

- A. ANSI American Nation Standards Institute
- B. NFPA 70 – National Electrical Code

- C. UL Underwriters Laboratory
- D. California Building Code (CBC)
- E. California Electrical Code (CEC)

1.06 WARRANTY

- A. Refer to Division 01 -- Warranties

PART 2 – PRODUCTS

2.01 All products used on this project shall bear the label and be approved by Underwriters Laboratories unless otherwise approved in writing by District.

2.02 FASTENERS

- A. Mounting hardware and anchors recommended by the manufacturer of any material that shall be mounted to the building or structure.
 - 1. Sheet rock / drywall / wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
 - 2. Concrete / cinder block / solid masonry: Expanding compression type lag, expanding compression type bolt, expanding compression type, all-thread with nuts, or approved equal.
 - 3. Tile / Stucco / hollow masonry: Toggle bolts or approved equal.
 - 4. Wood: Lag screws, wood screws, or approved equal.
 - 5. Metal: Beam clamps, sheet metal screws, self-drilling screws or approved equal.

2.03 HANGERS AND SUPPORT

A. D-RINGS

- 1. Commercial grade

B. J-HOOKS

- 1. Commercial grade

2.04 SURFACE RACEWAY

- A. The District has standardized on Wiremold 800, 2300, 5400 and 5500 series for non-metallic surface raceway. Provide as required where cabling is routed through existing building.

2.05 CONDUITS AND ACCESSORIES

A. CONDUITS

1. See Division 26 for requirements.
2. Conduit for Fire Alarm applications shall be red in color (non-accessible areas are excluded).
3. All new conduits shall be sized accordingly to achieve a 40% maximum fill ratio with initial cables installed.

B. INNERDUCT

1. Orange corrugated HDPE (High Density Polyethylene) Innerduct shall be used for fiber optic cable protection in interior locations.
2. Fabric multi-cell innerduct is approved for underground conduits 2" and larger.

C. FITTINGS:

1. See Division 26 for requirements.
2. Conduit bodies and any sharp bend fittings are strictly prohibited for communication Cat6A and fiber optic cables. Appropriate conduit sweeps are required.

D. PULL LINE

1. Minimum 1/8" diameter, or larger braided line of polypropylene or continuous fiber polyolefin. The minimum breaking strength of 1/8 in. line is 200 lbs.

2.06 BACKBOXES, JUNCTION BOXES AND FLOOR BOXES

- A. Galvanized one-piece or welded pressed steel type. Boxes for fixture shall not be less than 4" square and shall be equipped with fixture stud. Boxes shall be at least 2-1/8" deep, 4" square for 1 or 2 gang devices, with device rings. Boxes mounted in wall or ceiling finished with gypsum board shall be furnished with 5/8" deep device rings. Provide blank cover for all boxes without fixture or device.
- B. Junction boxes, larger than 8", located indoors shall be hinged, NEMA-1 rated.
- C. Junction boxes, larger than 8", located outdoors, or in wet or damp locations shall be hinged, NEMA-3R.
- D. Provide and install tamper-proof screws for all exterior boxes.
- E. Junction boxes used for Fire Alarm systems are to be red in color with red colored cover plates.

2.07 GROUND BOXES

- A. See Division 26 for requirements.
- B. Approved manufactures are Jensen, Christy or approved equal.
- C. All ground boxes shall have metal traffic-rated lids with permanent factory markings of COMM or COMMUNICATIONS.
- D. Minimum size is 17" x 30"

2.08 PENETRATION SEALING

- A. Firestopping: Provide UL Listed Firestopping materials for all penetrations through rated assemblies (walls / floors).
- B. Draft stopping: Foam sealant for use around conduit penetrations (in non-rated assemblies) to prevent passage of air, smoke, and/or toxic gas.
- C. Weatherproofing: Weatherproof sealant for use around conduit penetrations in exterior walls to prevent the intrusion of water.

2.09 GROUNDING BUS BAR

- A. Copper bus bar 2"x10"x1/4" minimum size with stand-off brackets and insulators, pre-drilled and threaded mounting holes (hole qty. 12 or greater) for equipment grounding lug attachment.

PART 3 - EXECUTION

3.01 COMMUNICATION SERVICES

- A. Install underground boxes, conduits, and terminal cabinets per service provider requirements.

3.02 GROUNDING

- A. Ground fittings shall be UL approved for each application and installed and/or connected to system in accordance with current CEC Code requirements.
- B. See Division 26 for additional requirements.
- C. Install grounding bus bar per manufacturer's instructions and to be in each MDF and IDF.

3.03 HANGERS AND SUPPORTS

- A. Install hangers and supports per manufacturer's written instructions.
- B. Hanger spacing shall be 48" or less and within 12" of sleeves and/or junction/back boxes.

3.04 LOW VOLTAGE PATHWAY/RACEWAYS

- A. EMT conduit may be used at following locations (see Division 26 for exact requirements):
 - 1. In dry locations in furred spaces.
 - 2. In partitions other than concrete or solid masonry.
 - 3. In protected exterior locations not exposed to direct weather.
- B. Rigid steel conduit and fittings shall be used for vertical risers and on top of all roofs, overhangs, walkways, canopies, or any other location exposed to direct weather. See Division 26 for exact requirements.
- C. Furnish and install pull lines in all unused (empty) conduits or raceways. All pull lines shall be permanently tagged with identification at both ends.
- D. Install exposed conduit neatly, parallel to or at right angles to structural members. Maintain a minimum of 12 inches of clearance from steam or hot water pipes. All installed strut channel supports should allow for future conduit attachments. The width of strut channel to match the width of the closest attached junction box. See design document details for attachment requirements.
- E. Supports: Support conduit with two-hole straps or strut channel where shown in design documents and/or specified. Coordinate supports with architectural details. Secure to wood structure by means of bolts or lag screws, to metal by means of shallow self-tapping screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry or stucco by means of toggle bolts.
- F. Spacing for all EMT and rigid steel conduit supports shall be as follows unless otherwise specified in design documents details:
 - 1. Surface conduit spacing and supports and unless otherwise specified or shown on drawing details:
 - a. EMT – Size 3/4" to 2" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.
 - b. Rigid steel – Size 3/4" to 2" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.
- G. If conduit is designated for low voltage use, no more than a total of 360 degrees of conduit bend radius will be allowed between pull boxes.

- H. All junction boxes shall be connected to conduits using appropriate connecting hardware (i.e. box connectors).
- I. Clean, prep and paint with white primer all exposed conduit, junction boxes, channel strut, fittings, and accessories.
- J. Before pulling any conductors into an underground PVC conduit (new or existing), the conduit shall be first be proofed by pulling through a mandrel of a diameter $\frac{1}{4}$ in. smaller than the conduit inside dia., followed by a swab of the same diameter as the conduit inside diameter.
- K. Non-metallic raceway to be installed with mechanical fasteners only, do not remove adhesive tape backing.
- K. CAPPING
 - 1. Cap conduits during construction with manufactured seals. Swab out conduits before installing wires.
 - 2. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of debris, attach pull string to cap.

3.05 J-BOXES

- A. Screws shall be used to attach boxes, and must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers.
 - 1. Boxes shall be attached to metal studs with metal box hangers.
 - 2. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.
- B. Locate outlets at the following heights unless otherwise noted on Drawings, Specifications, current CBC or as required to meet ADA handicap requirements.
 - 1. Data Outlets: Same height as electrical outlets
 - 2. Telephone Wall Outlets: Above counter/backsplash height or at electrical switch height.
- C. Boxes shall be placed within 18" of electrical outlets.
- D. For sound control, separate outlets on opposite sides of walls 16" minimum. Where outlets are less than 16" or in sound rated walls, seal airtight with fire rated sheet putty pads. Fill gap between junction box and wall with acoustical sealant all around perimeter of junction box. Fill conduits larger than 1 1/4" with fire rated putty.

- E. Installation of conduit and outlet boxes in fire-resistive walls, floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 713.

3.06 UNDERGROUND BOXES

- A. To be installed per Division 26 requirements.
- B. Provisions to be made for supporting cables from the box sides (i.e., j-hooks, d-rings)

3.07 SLEEVES AND CONDUIT PENETRATIONS

- A. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceways mounted to the same wall as the penetration provide a threaded conduit and secured in place with locking rings on both sides. Bend radius requirements shall be maintained where penetrations are made through the back of raceways; junction boxes with adequate depth shall be installed to comply with this requirement.
- B. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceways not mounted to the same wall as the penetration, provide EMT conduit and secured in place with strut channel. Box connectors shall always be used to connect EMT to junction boxes and raceways.

C. FIRE STOPPING

- 1. Seal all conduit penetrations through fire rated walls and floors fire and smoke tight in conformance with current CBC and current CEC.

D. DRAFT STOPPING

- 1. All non-fire rated walls must be draft stopped and sealed. Submit method to be used for approval by inspector and/or project manager. Mineral wool is one product that may be used.

E. WEATHER SEALING

- 1. All exterior penetrations shall be sealed watertight. The contractor shall use silicon rubber caulk or other approved methods and materials. Submit method and material with inspector and/or project manager.

3.08 CLEANING

- A. Clean all work prior to concealing, painting, and acceptance. Performed in stages if directed.
- B. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance.

C. Remove debris from inside and outside of equipment and enclosures.

3.09 FINAL DOCUMENT SUBMITTALS

A. See 27 00 00 for more information.

END OF SECTION

SECTION 27 10 00
STRUCTURED CABLING

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable Structured Cabling communications system. The system shall provide highly reliable and high-performance data communication from main distribution frame (MDF) through each intermediate distribution frame (IDF) to end points requiring fiber optics and/or copper cabling and associated equipment.
- B. This section condenses sections 27 11 00 – Communications Equipment Room Fittings, 27 13 00 – Communications Backbone Cabling, 27 15 00 – Communications Horizontal Cabling and 27 16 00 – Communications Connecting Cords into one comprehensive section.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
 - 1. Contractor shall furnish and install all required components and accessories as outlined in the design documents for a complete and operable turn-key system.
 - 2. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the standards and requirements prior to beginning work
 - 3. The Contractor shall furnish and install all required fire-treated $\frac{3}{4}$ " (three quarter inch) plywood for the MDF and all IDF locations.
 - 4. The Contractor shall furnish and install a ground bus bar at the MDF and IDF rooms.
 - 5. The Contractor shall furnish and install all required racks and cabinets.
 - 6. The Contractor shall furnish, install, and configure uninterruptable power supply(ies) (UPS) for the MDF and/or IDF racks.
 - 7. The Contractor shall furnish and install all newly required conduit/raceway.
 - 8. The Contractor shall furnish and install all wire/cable (copper/fiber optic) as required.
 - 9. The Contractor shall terminate all strands of fiber at each fiber enclosure.
 - 10. The Contractor shall furnish and install termination all end-point equipment (patch panels, jacks, wallplates, enclosures, etc.).
 - 11. The Contractor shall furnish and install all patch cords (copper/fiber).
 - 12. The Contractor shall test and certify installed cable plant.

1.03 RELATED REQUIREMENTS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Section 27 00 00 – Communications
- C. Section 27 05 00 – Common Work Results for Communication Systems.

1.04 INDUSTRY GUIDELINES AND STANDARDS

- A. California Electrical Code (CEC) – Current adopted version
- B. California Building Code (CBC) – Current adopted version.
- C. ANSI/TIA-568.0-D – Generic Communications Cabling for Customer Premises.
- D. ANSI/TIA-568.1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.
- E. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- F. ANSI/TIA 568.3-D – Optical Fiber Cabling Components Standard
- G. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.
- J. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.
- K. ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.

1.05 QUALIFICATIONS

- A. The contractor shall possess a California C7 or C10 license.
- B. The Contractor or Subcontractor shall have 5 years' documented experience.

1.06 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

1.07 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.

1.08 SUBMITTALS

- A. See section 27 00 00 for requirements.

1.09 WARRANTY

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.
- C. 15-year manufacturer's warranty/certification required for all copper and fiber cable plant installations.

1.10 CLOSEOUT DOCUMENTS

- A. See section 27 00 00 for requirements.

PART 2 – PRODUCTS

2.01 GENERAL

- A. See Appendix A at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Contractor shall confirm all equipment part numbers with the Project Manager or District prior to ordering equipment and updating submittals as required.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. The Contractor shall provide all components needed for complete and satisfactory installation and operation.
- E. Install mounting hardware and anchors as recommended by the Manufacturer of the equipment that requires mounting to the building or structure and adhere to all code requirements. See section 27 05 00 for requirements.
- F. Product Availability
 - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2.02 MANUFACTURERS AND PRODUCTS

- A. See Appendix A at the end of this document for pre-approved materials.
- B. Substitutions require proof of equivalence and approval by District and/or its representative.

2.03 COPPER/FIBER OPTIC CABLES AND COMPONENTS

- A. All copper cables and components shall be Cat6A rated.
 - 1. Cable to be reduced diameter.
 - 2. Jacks to be keystone style.
- B. Patch cords system/color:
 - 1. Data = Blue color
 - 2. AP = Green color
 - 3. CCTV = Blue color
 - 4. Clock/Intercom = Yellow color
 - 5. Access Control = Black color
- C. Data jacks system/color:
 - 1. Data = White color
 - 2. AP = Green color
 - 3. CCTV = Blue color
 - 4. Clock/Intercom = Yellow color
 - 5. Access Control = Black color
- D. All fiber optic cables and components shall be single single-mode OS2 rated.
- E. Fiber optic cable terminations shall be LC-Duplex style.

PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The components making up the equipment room and enclosures shall only be installed by Contractors who are qualified to install, service and maintain the system.
- B. Cable terminations (copper or fiber) shall be installed by manufacturer certified technicians.
- C. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to job bidding. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for accurate bidding and performance of the Work.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall verify the availability of power where required.

3.04 SHOP DRAWINGS

- A. The Contractor shall create "Shop Drawings" per section 27 00 00 for this section.
- B. Submit drawings for review and approval by the Project Manager.

3.05 INSTALLATION

A. ENTRANCE FACILITIES

- 1. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.
- 2. Install underground or aerial pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

B. UNDERGROUND ENTRANCE PATHWAY

- 1. Install underground entrance pathway complying with Division 26.

C. EQUIPMENT RACKS, CABINETS, ENCLOSURES AND ACCESSORIES

- 1. Backboards:
 - a. Shall be installed behind the rack or cabinet if the cabinet is not able to be directly attached to two vertical wall studs.
 - b. Backboards shall be made of fire retardant or treated materials, squarely cut, and with sanded edges
 - c. Backboards shall be a minimum ¾" thick and large enough to secure it to two vertical wall studs.

- d. The "FIRE RATED" stamp shall be visible.
 - e. Backboards shall be fastened with ¼" lag bolt and washer, non-recessed, with maximum spacing of 18" into 2 vertical studs.
2. All data & voice communications racks and cabinets shall be anchored in accordance with manufacturer's specifications, project specifications and/or drawn details, to walls and floors and grounded to building ground grid (not to water pipes etc.).
 3. Securely mount equipment cabinet and racks to the building structure. A proper quantity of support fasteners shall be utilized. Typically lag bolts for wood installations, wedge anchors for concrete flooring. Submit data sheets for mounting fasteners for approval before installation. Mount equipment per DSA approved drawings/details.
 4. Equipment cabinet mounted on or against walls will have 3-foot clearance in front of deepest component and accessible to rear for service.
 5. MDF and all IDFs shall have at least one dedicated 120VAC quad-receptacle each.
 6. Patch Panels: Mount patch panels into the cabinet/rack. Match manufacturer of existing install or if new construction, see Appendix A.
 7. Cable Management: Secure the cable bundle(s) to the rack strain relief and cable management behind the patch panels and cross connect block panels. Install horizontal cable management panels and brackets for routing and management of patch cables. Maintain TIA/EIA and BICSI standards on bundling, supporting and bend radius.
 8. Surge Protected Outlet Strips: Required in MDF rack. Mount surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.
 9. Furnish and install UPS in bottom of MDF/IDF rack.

D. MDF/IDF GROUNDING

1. Refer to Section 27 05 00 Grounding for more requirements.
2. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 6 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
3. Bond metallic equipment (including ladder rack) to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.06 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.
- B. The District' Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.
- C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- D. Perform Work with persons experienced and qualified to produce workmanship specified.
- E. Maintain quality control over suppliers and Subcontractors.

3.07 WIRE/CABLE (COPPER/FIBER OPTIC)

- A. Design, layout, size, and plan new cable runs as required.
- B. All wire and cable passing through metalwork shall be sleeved by an approved grommet or bushing.
- C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
- D. Neatly dress and tie (Velcro) all cabling.
- E. UTP cabling shall conform to a 6-foot separation requirement from the main power panel, transformers, switchgear and/or starter motors adjacent to the MDF, IDF and termination locations.
- F. Fiber optic cable shall be installed from the MDF to each IDF.
- G. Orange corrugated HDPE (High Density Polyethylene) Innerduct shall be used for fiber optic cable protection in all interior locations.
- H. Spicing of fiber optic cable shall be done with fusion splices.
- I. When required copper feeders (minimum 4-pair) are to be installed from the MDF to each IDF
- J. Maintain proper bend radius for all cable installations.
- K. Do not exceed cable manufacturer's instructions for installation pull load. Any cable damaged by excessive pull force shall be replaced by the installing contractor.
- L. Modular plug terminated link (MPTL) style wiring is acceptable for CCTV with modified single connector permanent link testing.

3.08 LABELING

- A. MDF/IDF - Identification number in large font on front of cabinet.
- B. MDF, Fiber Optic LIU Ports – IDF number and room number
- C. MDF/IDF, Copper Patch Panel – Panels labeled P1, P2, P3, etc., ports labeled with room number.
- D. LAN Outlet – IDF number, patch panel number, patch panel port number.
- E. Cables to be labeled both ends with unique identifiers and from/to location identifiers. For Copper Cat cable IDF number, patch panel number, patch panel port number and from/to identifier (i.e. room number).
- F. T-bar ceilings shall have device labels attached next to the device for ceiling mounted equipment and at the tile for above ceiling equipment with device type and device ID points/IP address.

3.09 CONDUIT AND RACEWAY INSTALLATION

- A. See Division 26 and section 27 05 00 for requirements.
- B. Conduit bodies and any other sharp bend fittings are strictly prohibited for communications cabling (copper/fiber).
- C. Install proper radius conduit sweeps where required.

3.10 FIELD QUALITY CONTROL AND TESTING

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system, the Contractor shall have personnel available with tools and equipment to inspect wiring, devices, and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify the District when ready to perform a re-inspection of the installation.
- F. Provide 15-year manufacturer's warranty/certification documentation for all copper and fiber cable plant installations.

3.11 CLOSEOUT DOCUMENTS

A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Wall Mount Cabinet 48"	DAMAC	WSR48ABP1VVV-3GP
20 AMP Power Strip	DAMAC	P0828GM201
Patch Panel 48-port 2-RU (Black)	Ortronics	KSU48
Faceplate, 2-port (Ivory)	Ortronics	KSFP2-99
Faceplate, 4-port (Ivory)	Ortronics	KSFP4-99
Surface Mount, 2-port (White)	Ortronics	KSSMB2
Cat6A Data Jacks (White)	Ortronics	KT2J6A-88
Cat6A Data Jacks (Green)	Ortronics	KT2J6A-45
Cat6A Data Jacks (Blue)	Ortronics	KT2J6A-36
Cat6A Data Jacks (Yellow)	Ortronics	KT2J6A-44
Cat6A Data Jacks (Black)	Ortronics	KT2J6A-00
Cat6A Data Cable, Reduced Diameter, Riser (White = default)	Berk-Tek	11143100
Cat6A Data Cable, Reduced Diameter, Plenum (White = default)	Berk-Tek	11141651
Cat6A Data Cable, Reduced Diameter, Riser (Blue = CCTV/Access Control)	Berk-Tek	11142398
Cat6A Data Cable, Reduced Diameter, Plenum (Blue = CCTV/Access Control)	Berk-Tek	11141650
Cat6A Data Cable, Reduced Diameter, Indoor/Outdoor (Black)		
Cat6A Patch Cord (Blue)	Quiktron	576-A10-0xx (xx = length)

Cat6A Patch Cord (Green)	Quiktron	576-A20-0xx (xx = length)
Cat6 Patch Cord Slim 1' (Blue)	C2G	01072
Cat6 Patch Cord Slim 1' (Green)	C2G	01160
Fiber Optic LIU 1-RU	Ortronics, Infinium	INFC01U-M4-E
Fiber Optic LIU 2-RU	Ortronics, Infinium	INFC02U-M4-E
Fiber Optic Adapter	Ortronics, Infinium	HDFP-LCD12AC
Fiber Optic LC Field Term Connector	Ortronics	205KAN9GASM
Fiber Optic Fanout Kit	Ortronics	61500858
Fiber Optic Cable Single-Mode OS2, Indoor/Outdoor	Superior Essex	W4012J101
Fiber Optic Cable Single-Mode OS2, Indoor/Outdoor	Berk-Tek	PDP012AB0707-I/O-C4(YEL)

END OF SECTION

SECTION 27 21 00

DATA COMMUNICATIONS NETWORK EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable data network system. The system shall provide reliable and high-performance data communication throughout the site.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
 - 1. Provide, coordinate, and install all required equipment and accessories as outlined in the design documents for a complete and operable system.
 - 2. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, components, equipment, tools, utilities, construction equipment and machinery, transportation, and other facilities and services necessary for the proper execution, operation, and completion of a turn-key system to the District.
 - 3. Data Communications Network Equipment: Includes, but is not limited to:
 - a. Wireless Access Points

1.03 RELATED REQUIREMENTS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Section 27 00 00 - Communications
- C. Section 27 05 00 - Common Work Results for Communication Systems.
- D. Section 27 10 00 - Structured Cabling

1.04 QUALIFICATIONS

- A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- B. Five years' experience installing data network equipment and systems.

1.05 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data network infrastructure.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.

1.07 SUBMITTALS

- A. See section 27 00 00 for requirements.

1.08 WARRANTY

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

1.09 CLOSEOUT DOCUMENTS

- A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. See Appendix A at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation/operation.
- D. Product Availability
 - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
 - 2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

- A. The District's preferred manufacturer for:
 - 1. Wireless Access Points - Aruba
- B. Substitutions require proof of equivalence and approval by District and/or its representative.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing data network equipment before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to bidding for the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the Project Manager of long lead time items.
- B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the Project Manager.
- C. The Contractor shall coordinate with the District's Technology Services department for needed IP addresses at least 2 weeks prior to configuration/installation.

3.04 SHOP DRAWINGS

- A. The Contractor shall create "Shop Drawings" per section 27 00 00.

3.05 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.
- B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.
- C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- D. Perform Work with persons experienced and qualified to produce workmanship specified.
- E. Maintain quality control over suppliers and Subcontractors.

3.06 PATHWAY AND EQUIPMENT INSTALLATION

- A. Install all conduit and pathway per design documents. Refer to 27 05 00 for additional information/requirements.
- B. Install all Cat6A cable per design documents. Refer to 27 15 00 for additional information/requirements.
- C. Equipment to be installed per manufacturer's instructions.
- D. Devices requiring PoE power shall be connected to a PoE switch in the MDF/IDF data rack – verify with Technology Services for available PoE power.

3.07 CONFIGURATION

- A. Any information needed from the District for configuration of equipment (i.e. VLAN, etc.) needs to be requested in writing 2 weeks prior.
- B. All equipment to be fully configured and tested for functionality by the Contractor prior to District acceptance testing.

3.08 FIELD QUALITY CONTROL AND TESTING

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify the District of readiness to perform the formal Test & Inspection of the complete system by the District or its representative. Make all adjustments/changes required from District/representative review.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.

- C. During the formal Test & Inspection (Commissioning) of the system and have personnel available with tools and equipment to inspect wiring, devices, and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify the District when ready to perform a re-inspection of the installation.

3.10 AS-BUILT DRAWINGS

- A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
DAC Cable 1 Meter	Aruba	J9281D
SFP+ Transceiver	Aruba	J9151E
Wireless Access Point, Interior Ceiling Mount	Aruba	Q9H63A/AP-515
Access Point Mounting Bracket, Solid Surface	Aruba	R3J18A/AP-MNT-D
Wireless Access Point, Exterior Wall Mount	Aruba	R4W49A/AP-567
Access Point Mounting Bracket, Outdoor AP, Solid Surface	Aruba	R6W11A/AP-270-MNT-H3
Aruba Central AP Foundation 5y Sub E-STU	Aruba	Q9Y60AAE

END OF APPENDIX A

END OF SECTION

SECTION 28 20 00

VIDEO SURVEILLANCE

PART I - GENERAL

1.01 SUMMARY

- A. This section specifies software, equipment, accessories, wire, materials, installation, configuration, and testing requirements for a complete and operable Video Surveillance system. The system shall provide electronic recording/playback and monitoring of digital cameras installed at the site.

1.02 SCOPE

- A. The work will include but not be limited to the following objectives:
 - 1. Labor and Materials: The Contractor shall provide and pay for all labor, supervision, materials, accessories, wire, components, equipment, tools, transportation, and other facilities and services necessary for the proper installation of a turn-key Video Surveillance system to District.
- A. The CCTV system shall have the following minimum requirements.
 - 1. Cameras
 - a. Weather resistant IP67 or greater (exterior only)
 - b. Network/IP based
 - c. PoE powered
 - d. 5MP or 4K resolution
 - e. H.265 video compression
 - f. Day/night with IR illumination
 - g. Motion detection
 - h. ONVIF
 - 2. Network Video Recorder
 - a. Network/IP based
 - b. H.265 video compression
 - c. RAID 5 or greater
 - d. Record on motion detection
 - e. 30+ day recording
 - C. Software
 - a. PC and Mobile viewing
 - b. View live and recorded video
 - c. Search
 - d. Save video to MP4 format
 - e. Notifications

1.03 RELATED REQUIREMENTS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Section 27 00 00 - Communications
- C. Section 27 05 00 - Common Work Results for Communication Systems.
- C. Section 27 10 00 - Structured Cabling

1.04 QUALIFICATIONS

- A. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- B. Five years' experience installing Video Surveillance equipment systems.

1.05 SYSTEM REQUIREMENTS

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing Video Surveillance system.

1.06 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

- A. See section 27 00 00 for requirements.
- B. Shop drawings are required for this section

1.07 SUBMITTALS

- A. See section 27 00 00 for requirements.

1.08 WARRANTY

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

1.09 CLOSEOUT DOCUMENTS

- A. See section 27 00 00 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. See Appendix A at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation/operation.
- D. Product Availability
 - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
 - 2. Subject to compliance with these specifications, products and systems included in this section are to be installed as specified by the manufacturer of the system or engineer approved equal.

2.02 EQUIPMENT

- A. The District's preferred manufacturer for CCTV equipment is i-Pro (formally Panasonic) for cameras and network video recorders (NVR).
- B. Substitutions require proof of equivalence and approval by District and/or its representative.
- C. All exterior cameras to be IP67 rated or better.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. The equipment shall only be installed by Contractors who are qualified to install and maintain the system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience installing Video Surveillance equipment before the Bid Opening Date.

3.02 EXAMINATION

- A. The Contractor shall be required to visit the installation site(s) prior to job bidding. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to District.

- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

3.03 PREPARATION

- A. The Contractor shall verify materials are readily available prior to submitting product submittals and notify the Project Manager of long lead time items.
- B. The Contractor shall order all required parts and equipment only after receipt of approved product submittals from the Project Manager.
- C. The Contractor shall coordinate with the District's Technology Services department for needed IP addresses at least 2 weeks prior to configuration/installation.

3.04 SHOP DRAWINGS

- A. The Contractor shall create "Shop Drawings" per section 27 00 00.

3.05 WORKMANSHIP

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship.
- B. The District's Project or Construction Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.
- C. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- D. Perform Work with persons experienced and qualified to produce workmanship specified.
- E. Maintain quality control over suppliers and Subcontractors.

3.06 PATHWAY AND EQUIPMENT INSTALLATION

- A. Install all conduit and pathway per design documents. Refer to 27 05 00 for additional information/requirements.
- B. Install all Cat6A cables per design documents. Refer to Section 27 10 00 for additional information/requirements.
- B. Equipment to be installed per manufacturer's instructions.
- C. Devices requiring PoE power shall be connected to a PoE switch in the MDF/IDF data rack – verify for adequate PoE power capacity.

3.07 CONFIGURATION

- A. Program cameras and/or NVR with network IP address using the following scheme.

Note: x=site octet, contact District Electronics shop for site information.

1. Cameras: 10.x.253.101 = Camera 1, 10.x.253.102 = Camera 2...
2. NVR: 10.x.253.1
3. POE Switch: 10.x.253.10 = 1st switch, 10.x.253.11 = 2nd switch...
4. Gateway: 10.x.0.1
5. Subnet Mask: 255.255.0.0

- B. All equipment to be fully configured and tested for functionality prior to District acceptance testing.

3.08 CAMERA VIEW

- A. Adjust view aim, zoom and focus camera to show intended view from design documents.

3.09 FIELD QUALITY CONTROL AND TESTING

- A. Upon completion of network programming and initial view setting, notify District of your readiness to perform the formal camera view review with District or its representative. Make all adjustments required from District review.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system, Contractor to have personnel available with tools and equipment to inspect wiring, devices, and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify the District when ready to perform a re-inspection of the installation.

3.10 AS-BUILT DRAWINGS

- A. See section 27 00 00 for requirements.

APPENDIX A – Pre-Approved Materials**VIDEO SURVEILLANCE:**

DESCRIPTION	MFG.	PART NUMBER
Network Video Recorder 48TB	i-PRO	NVR-RL-48TB-V3
NVR license	i-PRO	ASM-300
Network Dome Camera, Outdoor, Vandal Resistant, 5MP with Base Bracket	i-PRO	WV-S2552L
Network Dome Camera, Indoor, 5MP with Base Bracket	i-PRO	WV-S2252L
Network Camera, Outdoor 360-degree, Vandal Resistant, 5MP with Base Bracket	i-PRO	WV-S4551L
Pendant Wall Mount Kit	i-PRO	PWM485S
Pendant Corner Mount Kit	i-PRO	PCM485S
Pendant Pole Mount Kit	i-PRO	PPM485S
Wall Mount Bracket	i-PRO	WV-QWL500-W
Sunshade	i-PRO	WV-QSR500-W
Dome Cover	i-PRO	WV-CW7SN
2 RU Din Rack Mount Adapter	Antaira	DIN-Rack-2U
240W Power Supply	Antaira	NDR-240
960W Power Supply	Antaira	SDR-960-48
10-Port Industrial Gigabit PoE+ Managed Ethernet Switch	Antaira	LMP-1002G-SFP
20-Port Industrial Gigabit PoE+ Managed Ethernet Switch	Antaira	LMP-2004G-SFP
28-Port Industrial Gigabit PoE+ Switch 1RU	Antaira	LNP-2804GN-SFP-T
Gigabit Ethernet-Single Mode Transceiver	Antaira	SFP-S10-T

END OF APPENDIX A

END OF SECTION

SECTION 28 46 00

FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.01 SUMMARY

- A. This section specifies equipment, accessories, wire, materials, installation, configuration and testing requirements for a complete and operable Fire Detection and Alarm system. The system shall provide fire alarm detection, notification, monitoring, command, and control and be connected to the District's existing UL listed monitoring station.

1.02 SCOPE

- A. The installed Fire Alarm system shall comply with all requirements of currently adopted version of NFPA 72.
- B. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the District's standards and requirements prior to beginning work.
- C. For new building construction on an existing campus – provide and install all components and accessories as outlined in the design documents for a complete and operable system that extends and seamlessly integrates into the existing campus' Fire Alarm system.
- D. For construction in existing buildings - provide and install all components and accessories as outlined in the design documents to modify the existing system while maintaining code compliance and to seamlessly integrate the new components into the existing campus' Fire Alarm system. Prior to beginning any work, the Contractor is responsible for identifying any existing system errors or faults and bring these issues to the attention of the District Project Manager.
- E. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation, and completion of the Work
- F. Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system to the District.
- G. The Contractor shall be responsible for programming of all Fire Alarm Control Panel(s) (FACP) site wide.
- H. With one-week notice the Contractor shall coordinate with the District staff for monitoring connectivity.

- I. Prior to final programming the contractor shall review the proposed final system programming, functionality and expectations with the District project manager, and/or Designer/Engineer. If the system is programmed without approval, all subsequent requested programming changes by the District will be at the Contractor's expense.
- J. After completion of the installation and 100% pretest of the system, a satisfactory final test (compliant with NFPA 72 requirements) of the entire system shall be made in the presence of the inspector of record (IOR) and District or the District's representative.
- K. Provide District an electronic copy of final test results.
- L. Existing system shall remain operable until new system is accepted and approved by the IOR and the District or its representative.
- M. The Contractor is responsible for user/operator training (2 hours).
- N. The Contractor shall complete all required project closeout documentation in a timely fashion.

1.03 RELATED REQUIREMENTS:

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
- B. Division 26 – Electrical
- C. Section 27 00 00 – Communications
- D. Section 27 05 00 – Common Work Results for Communication Systems

1.05 CODES AND STANDARDS:

- A. The installed system shall conform to all California State Codes
 - 1. 2022 California Building Code (CBC)
 - 2. 2022 California Electrical Code (CEC)
 - 3. 2022 California Fire Code (CFC)
 - 4. All equipment shall have California State Fire Marshall listing(s)
 - 5. DSA IR 9-1 Emergency Voice/Alarm Communication Systems
 - 6. DSA IR 9-2 Carbon Monoxide Detection Requirements for Group E Classrooms and Group I-4 Occupancies
- B. National Fire Protection Association (NFPA) - USA:
 - 1. NFPA 70 - National Electric Code (NEC)
 - 2. NFPA 72 - National Fire Alarm Code (NFPA 72)

3. NFPA 101 - Life Safety Code (NFPA 101)
 4. Americans with Disabilities Act (ADA)
- C. Local building codes
- D. All requirements of the Authority Having Jurisdiction (AHJ)
- 1.06 UNDERWRITERS LABORATORY (UL) LISTING
- A. All equipment shall be UL listed for its intended purpose.
 - B. Any modification that voids the equipment's UL listing is strictly prohibited (i.e. relocated or oversize knock-outs).
 - C. Any modified new equipment that voids the UL listing shall be replaced by the Contactor (parts and labor) at their expense.
- 1.07 QUALIFICATIONS:
- A. The Contractor shall possess a California C10 license.
 - B. The installing Contractor or Subcontractor shall be FACP manufacturer authorized to provide and install equipment with 5 years of documented experience.
 - C. The programming technician shall possess a valid manufacturer's programming certification.
 - D. The Contractor shall have at least one NICET certified in Fire Alarm Technology, level II (or greater) personnel as the on-site supervising technician who is always on site when Fire Alarm activities are taking place.
 - E. The installing company and its subcontractors shall have an office located within 50 miles of the project site.
- 1.07 REFERENCES
- A. See Section 27 00 00
- 1.08 SYSTEM REQUIREMENTS
- A. Site Compatibility
 1. Any new installations or modifications to an existing system shall seamlessly integrate into the site's existing Fire Alarm system.

1.09 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS

A. See Section 27 00 00 for requirements.

1.10 SUBMITTALS

A. See Section 27 00 00 for requirements.

B. Provide copies of certificates listed in QUALIFICATIONS section above.

1.11 WARRANTY

A. Refer to Division 01 Warranty section.

B. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day "burn-in" period shall begin. Any fault shall reset the "burn-in" period to zero (0). Warranty shall commence at day 31 of a successful and continuous "burn-in" period.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIAL, GENERAL:

A. Existing system is by Notifier.

B. See Appendix A for pre-approved equipment listings.

C. All products shall be new and unused and shall be of manufacturer's current and standard production.

D. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.

E. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory system operation.

F. Product availability:

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.
 - G. In compliance with DSA IR 9-2 for CO Detection, in areas where CO detection is needed EVAC notification appliances will be utilized for Fire Alarm and Carbon Monoxide alerts, promoting a building wide evacuation. For this reason, interior notification appliances (Speaker/Strobes) shall not have the word "FIRE" on the device.
- 2.02 CONDUIT AND RACEWAY
- A. See Section 27 05 00 for conduit and raceway requirements.
- 2.03 WIRE AND CABLE
- A. Provide all new wire and cable required to install systems as indicated on design documents or approved shop drawings.
 - B. Approved wire and cable manufacturer is West Penn, substitutions require prior approval.
 - C. All cable shall be jacketed, and jacket color shall be red (OSP cable excluded). No THHN/THWN allowed.
 - D. All cables shall be specifically designed for their intended use and install requirements (FPL, plenum, direct burial, aerial, etc.).
 - E. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG solid for initiating device circuits and signaling line circuits, 12 AWG stranded for notification appliance circuits and 14 AWG stranded for emergency voice communication circuits. (Coordinate with wire schedule)
- 2.05 BATTERIES
- A. Shall be new 12-volt, sealed lead-acid type.
 - B. Battery shall be sized according to calculations on design drawings.
 - C. Approved battery manufacturer: Powersonic or approved equal
- 2.06 EXTRA STOCK:
- A. For projects with less than 10 new Fire Alarm devices – no extra stock required.

- B. For projects with 11 – 50 new Fire Alarm devices – provide extra stock of 1 (ea.) Smoke detector (current model), 1 (ea.) Heat detector (current model) and 1 (ea.) Pull station (current model)
- C. For projects over 50 new Fire Alarm devices – provide extra stock of 2 (ea.) Smoke detector (current model), 1 (ea.) CO detector (current model), 1 (ea.) Wall speaker/strobe (current model) and 1 (ea.) Ceiling speaker strobe (current model) per 100 Fire Alarm device increments.
- D. For projects over 300 new Fire Alarm devices – provide devices listed in sections C (above) plus 1 (ea.) Power Booster (current model)

PART 3 – EXECUTION

3.01 INSTALLATION:

- A. The installing company shall employ a minimum of one National Institute for the Certification in Engineering Technologies (NICET) Fire Alarm Systems, level II technician. To ensure system integrity, the NICET level II technician shall be on site during all fire system related work to guide the installation of conduit, back-boxes, device placement, device installation, programming, pre-testing, and final testing of the system.
- B. The District, Inspector of Record (IOR), Construction Manager or an agent of the District shall have the authority to stop work until the certified personnel requirement is met. The Contractor shall be held accountable for meeting completion dates.
- C. Installation shall be in accordance with the CBC, CEC, CFC, NFPA 72, local and national codes.
- D. Fire Alarm cables shall not be installed in decking flutes used as pathway. Any conduit that needs to be ran in decking flutes needs to be rigid.
- E. All Fire Alarm cables shall be run unexposed (not observable from occupiable space) throughout the entire cable path – either in conduit, on ladder racking, on j-hooks above ceilings or below flooring.
- F. All fire devices and panels shall be mounted at the height as indicated on the design plans and shall comply with local, CBC, CEC, CFC, and NFPA 72 codes and standards. Any discrepancies shall be brought to the Designer/Engineer and Project Manager's attention.
- G. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place with fasteners and supports in accordance with drawings and specifications.
- H. Signal line circuits (SLC) for initiating devices shall be wired Class B.
- I. Notification appliance circuits (NAC) shall be wired Class B.

- J. CO detection to initiate a building wide evacuation in accordance with DSA IR 9-2.
- K. Smoke detectors shall remain covered until operational. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and/or physical damage and may require additional testing and/or replacement.
- L. All addressable smoke or heat devices shall have trim skirts.
- M. All modules with indicator lights (i.e. SIGA-CT1 & etc.) shall be mounted where the indicator lights are observable from the occupiable space.
- N. Smoke relief hatches are to have door contacts installed and monitored with a monitoring module. Opening of the hatch shall produce a Supervisory event notification. Monitoring module height is to be 10' AFF or less.
- O. Fire alarm circuits shall have a red breaker lock on device per NFPA 72 requirements.
- P. All modification to electrical power shall be made by a licensed electrician.
- Q. Headend FACP and associated equipment layout per design documents. If no layout exists Contractor to notify and receive guidance from District or District's representative prior to install.
- R. All Duct Smoke Detector / Fire Smoke Damper shutdown to be coordinated with Div 23.

3.02 LABELING

- A. All labels are to be machine generated black letters on white adhesive label stock that is appropriate for the installation environment (interior/exterior).
- B. Device ID Labels are to be 1/4" lettering for mounting heights 10' AFF or less, 1/2" black lettering on white labels for mounting heights greater than 10' AFF.
- C. All panels and power supplies shall be labeled indicating AC electrical power panel and circuit breaker number and panel location.
- D. All panels and power supplies shall be identified per design plans.
- E. All smoke and heat detectors shall be labeled with Point ID affixed to the trim skirt. Labels are to be visible when approaching the device from the room entry.
- F. All modules are to be labeled with Point ID and function and/or associated equipment (i.e. FAN SHUTDOWN, HVAC UNIT XX, ATTIC HEAT, etc.)

- G. All notification devices shall be labeled with NAC Point ID.
- H. All cables in cabinets shall be labeled with function and circuit ID.
- I. All end-of-line devices shall have a "EOL" label.

3.03 PANEL PROGRAMMING/SOFTWARE MODIFICATION

- A. The contractor shall review the proposed system programming, functionality, expectations with the District or its representative 10 days prior to final programming.
- B. Contractor shall provide the services of a factory trained, and authorized technician to perform all system software modifications, upgrades, or changes on site. No remote programming is allowed.
- C. Contractor shall provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system.
- D. Programming syntax shall be consistent with the with the existing site for label text and numbering scheme.

3.04 PRE-TESTING

- A. The entire system shall be checked and pre-tested by the Contractor and shall test free of all faults prior to calling for a final test.
- B. Before energizing the cables and wires, check for correct connections and test for open circuits, short circuits, ground faults, continuity, and any physical damage to the cable/wire insulation that may have occurred during installation.

3.05 TESTING AND GUARANTEE

- A. Upon completion of the installation of the system, a test consisting of 100% of all newly installed and 10% of existing relevant system components shall be performed to confirm operation and function. This test shall be made in the presence of the Inspector of Record (IOR) and the District or its representative.
- B. Provide the Project Manager with 7 days in advance written notice of system readiness for Final Testing and Inspection. System shall be 100% pre-tested and fully operable with no trouble conditions prior to final test.
- C. Provide the service of a NICET level II technician to supervise and participate during all of the adjustments and tests of the system.
- D. Testing and adjustments

1. Verify that all devices operate per Design documents matrix (matrices.)
2. Verify the Point IDs and descriptions as indicated on the updated (redlined) Design Documents Floor Plan.
3. Verify the candela settings of all NAC devices with strobes.
4. Verify the intelligibility for all EVAC notification appliance speakers.
5. Verify and document that sound levels at all EVAC notification appliance speakers meets or exceeds the minimum sound levels as indicated in the design drawings for expected average ambient or maximum sound levels. Testing to be conducted using dBA setting, 5' above finished floor and 10' from speaker with a stand-alone meter (Galaxy Check Mate series or equal).
6. Contractor to adjust speaker wattage settings as required to meet sound levels required after testing.
7. Verify proper alarm and trouble of all sprinkler system flow valve(s).
8. Verify that an open circuit on the initiating device circuit activates a trouble signal locally for all circuits.
9. Verify that an open or a short circuit on the signaling line circuit activates a trouble signal locally for all circuits.
10. Verify that an open or short circuit on the notification appliance circuit activates trouble signal locally for all circuits.
11. Verify that a ground condition on an initiating device circuit activates trouble signals locally for all circuits.
12. Verify that a ground condition on a signaling line circuits activates a trouble signals locally for all circuits.
13. Verify that a ground condition on a notification appliance circuit activates a trouble signal locally for all circuits.

3.06 DEMOLITION

- A. See section 27 05 00, for requirements

3.07 FINAL DOCUMENT SUBMITTALS

- A. See section 27 00 00, for additional requirements

- B. Submit completed NFPA certification forms as found in NFPA 72. Forms shall be submitted in typewritten format.
- C. Provide District an electronic copy of final test results.
- D. Contractor “red-line as-built” drawings shall also include the following: The drawings shall depict, at a minimum, the following conditions:
 - 1. The device exact installed location.
 - 2. Device updated labeling ID(s), which shall match the physical label at the device.
 - 3. Revised risers to match record set point to point installation and
 - 4. Updated battery calculation with quantity of device changes.
 - 5. New pathways, conduit, ground boxes, junction boxes, raceway, power-poles and floor-monuments.
 - 6. Any other new conditions.
- E. The Contractor shall submit “red-line as-built” drawings as indicated on project schedule.
- F. Warranty:
 - 1. Refer to Division 01 Warranty section.
 - 2. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day “burn-in” period shall begin. Any fault shall reset the “burn-in” period to zero (0). Warranty shall commence at day 31 of a successful and continuous “burn-in” period.

APPENDIX A – Pre-Approved Materials

DESCRIPTION	MFG	PART NUMBER
Horn/Strobe (Wall)	System Sensor	P2RL
Horn/Strobe (Ceiling)	System Sensor	PC2RL
Horn (Outdoor)	System Sensor	HRK
Terminal/Barrier Strip	Ideal Industries	89-608
Dry Contact Input Relay	Functional Devices, Inc.	RIB01BDC

Fire Alarm Control Panel	Notifier	Existing
Heat Detector (Rate of Rise)	Notifier	FST-951
Control Relay	Notifier	FRM-1
Isolator Module	Notifier	ISO-X
Remote Power Supply	Notifier	PSE-6

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 01 57 13, Erosion Control
4. Section 31 23 33, Trenching and Backfilling.
5. Section 32 12 00, Asphalt Concrete Paving.
6. Section 32 16 00, Site Concrete.
7. Section 32 80 00, Irrigation.
8. Section 32 90 00, Landscaping.
9. Section 33 40 00, Site Drainage.

1.02 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.03 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting of inadequate compaction or

moisture content is the sole responsibility of the contractor.

- D. Tests (See Part 3 for Compaction Testing).
- E. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the contractor. Contractor shall be solely responsible for any and all repairs.

1.04 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.05 REFERENCES AND STANDARDS

- A. General: Site survey, included in the drawings, was prepared by Warren Consulting Engineers, Inc, dated 7/28/2017, Project No. 17-115S, and is the basis for data regarding current conditions. While the survey is deemed generally accurate, there exists discrepancies and variations due to elapsed time, weather, etc. Existing dirt grades may vary 0.2 ft. from that shown.
- B. Geotechnical Engineering Report: A site specific geotechnical engineering report was and is entitled C.K. McClatchy High School Athletic Field Improvements, prepared on September 15, 2023 by Universal Engineering Services, project number 4630.2300087.0016. This report is on file with Architect. The Geotechnical report is the basis of design of the project and used as a reference in the development of the contract plans and specifications. The Geotechnical report shall be used only as a reference for the soil condition of the project site. The design information contained in the contract plans and specifications shall govern over the recommendation of the Geotechnical report.
- C. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.
- D. ANSI/ASTM D698-e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- E. ANSI/ASTM D1556-e1 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- F. ANSI/ASTM 698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- G. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- H. ANSI/ASTM D 4318-10e1 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- I. CALTRANS Standard Specifications Section 17.
- J. CAL-OSHA, Title 8, Section 1590 (e).
- K. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those

governing authorities have been notified.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.08 EXISTING SITE CONDITIONS

- A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.09 ON SITE UTILITY VERIFICATION AND REPAIR PROCEDURES

- A. Ground-breaking requirements:
 - 1. All underground work performed by a Contractor must be authorized by the District's Construction Manager or the Low Voltage Consultant prior to start of construction.
 - 2. The Contractor is to obtain and keep the original School's construction utility site plans on site during all excavation operations. Contractor can contact the District's Construction Manager, Facilities Manager, or the Low Voltage Consultant to procure the drawings.
- B. Underground Utility Locating:
 - 1. The contractor shall hire an Underground Utility Locating Service to locate existing underground utility pathways in areas affected by the scope of work for excavation.
 - 2. Contractor must use an underground utility locator service with a minimum of 3 years' experience. The equipment operator must have demonstrated experience.
 - 3. The Underground Utility Locator Service must have the use of equipment with the ability to locate by means of inductive clamping, induction, inductive metal detection, conductive coupling, or TransOnde (Radio detection) to generate signals, passive locating (free scoping) for "hot" electric, and metal detector.
 - 4. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72".

5. The Underground Utility Locator Service must be able to locate but are not limited to locating the following types of utility pathways:
 - a) All conduit pathways containing 110 volt or greater 50-60Hz electrical wire.
 - b) All conduit pathways containing an active cable TV system.
 - c) All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.
 - d) All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.
 - e) All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.
 - f) All plastic and other nonconductive water lines in which a TransOnde Radio detection) or other "transmitter" can be applied to create a low frequency pressure wave (signal) without damaging or triggering the existing systems.
 - g) All copper or steel waterlines and plastic or steel gas lines
6. All markings made by the Underground Utility Locator Service or other shall be clear and visible.
7. The contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.
8. The Underground Utility Locator Service shall provide the contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the district at no additional charge.
9. Contractor is responsible to contact Underground Service Alert (U.S.A. 800/227-2600) and receive clearance prior to any excavation operations.
10. Contractor shall inform the (District's Construction Manager) (Architect) (Owner) no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

1.10 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

1.11 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- B. Excessively wet fill material shall be bladed and aerated per section 3.08, B.

1.12 TESTING

- A. General: Refer to Section 01 45 00 – Quality Requirements.
- B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.
 - 1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.
 - 2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

1.13 ARCHEOLOGICAL AND CULTURAL RESOURCES

- A. If archeological or cultural resources are discovered during the Work, the Contractor must cease all construction operations in the vicinity of the discovery until a qualified archeologist can assess the value of these resources and make recommendations to the State Historic Preservation Officer. Archeological and cultural resources include artifacts, large amounts of bone, shell, or flaked stone, and other evidence of human activity. If the State Historic Preservation Officer or the Owner directs that work be temporarily ceased at the location of an archeological or cultural find, the Contractor must temporarily suspend work at the location.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer free from debris, and concentrations of clay and organics; and contain rocks no larger than Three (3)-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and

compaction. Clods, rocks, hard lumps or cobbles exceeding three (3) inches in final size shall not be allowed in the upper twelve (12) inches of any fill. Native clay or clayey soils will not be permitted within the upper twelve (12) inches of building pad areas or paved areas.

- B. Imported Engineered Fill Material: Imported fill may be required to complete work. Proposed import fill material shall meet the above requirements; shall be similar to the native soils. Import fill shall meet the above requirements; shall have plasticity index of 12 or less; an R-Value of 40 or Greater, an Expansion Index of 20 or less; be free of particles greater than three (3) -inches in largest dimension; be free of contaminants and have corrosion characteristics within the acceptable limits. All import fill material shall be tested and approved by Soils Engineer prior to transportation to the site. Proposed fill material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.
1. DTSC TESTING: Site work contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The costs associated with the testing will be paid by the contractor.
 2. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory (http://www.dtsc.ca.gov/Schools/upload/SMP_FS_Cleanfill-Schools.pdf). Soils shall be tested prior to import to the project site.
Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); (RWQCB) Regional Water Quality Control Board; or (OEHHA) Office of Environmental Health Hazard Assessment.
 3. Frequency of testing shall be conducted in accordance with DTSC’s Imported Fill Advisory as follows;

Fill Material Sampling Schedule

Area of Individual Borrow Area	Sampling Requirements
2 Acres or less	Minimum of 4 samples
2 to 4 Acres	Minimum of 1 sample every ½ Acre
4 to 10 Acres	Minimum of 8 Samples
Greater than 10 Acres	Minimum of 8 locations with 4 subsamples per location

Volume of Borrow Area Stockpile

Up to 1,000 Cubic Yards	1 sample per 250 cubic yards
1,000 to 5,000 Cubic Yards	4 samples for the first 1000 cubic Yards + 1 sample per each additional 500 cubic yards
Greater than 5,000 Cubic Yards	12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

4. Reports/ Documentation
 - a. Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC, and DSA. Letter shall reference DSA file and application numbers.

C. Landscape Backfill Material:

1. The top 3" of native topsoil stripped from the site may be used for landscape backfill material provided it meets the requirements as specified in Section 329000.
2. Imported Topsoil may be required to complete work. See Section 329000 for requirements. Proposed Topsoil material shall comply with DTSC guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material.

D. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

E. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

F. Decomposed Granite: Decomposed Granite shall be well graded mixture of fine to 1/8" particles in size with no clods. The material shall be free of vegetation, other soils, debris and rock. The material shall be reddish-tan to tan in color.

G. Decomposed Granite Solidifier: PolyPavement or equal.

PART 3 – EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

- A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence
- B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.
- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PERFORMANCE

A. GENERAL:

1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
2. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Architect for notification of appropriate authorities.

3. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.
4. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.03 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

- A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12", moisture-conditioned to 2% above the optimum moisture content, and recompactd to at least 90% of the maximum dry density.

3.04 TESTING AND OBSERVATION

- A. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.
- B. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.
- C. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.
- D. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.
- E. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.05 CLEARING AND GRUBBING

- A. Prior to grading, remove all debris off-site. Remove trees and brush including the root systems. All trees/large brush designated for removal should include the rootball and roots ½ inch or larger in size. This may require hand picking of roots which contractor shall include. Holes resulting from tree and brush removal should be prepared and backfilled in accordance with paragraphs 3.07, 3.08, 3.09, and 3.10. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip the surface of all organics. Stripping's meeting the requirements of Section 32 90 00 may be used in landscape areas only.

3.06 CUTTING

- A. Building pads that are located within a cut/fill transition area will have to be overexcavated to provide a semi-uniform fill beneath the building pad. The portions of building pads located in cut areas shall be overexcavated to provide no more than 1 foot difference in fill placed in the same building pad.
- B. Do all cutting necessary to bring finish grade to elevations shown on Drawings.
- C. When excavation through roots is necessary, cut roots by hand.
- D. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.
- E. Soils containing excessive organic soils should be removed and not used within the pavements, slabs, and building areas. For this project, the acceptable organic content is less than four percent (4%) organics by weight as determined by ASTM D2974 (Organic Content by Ignition Method). Soils containing organic material may be used in landscape areas with approval of the landscape architect after review.

3.07 STRUCTURAL EXCAVATION

- A. General: Excavate to bear on firm material at contract depth shown on Structural Drawings.
- B. Footings: All footing excavations shall be of sufficient width for installation of formwork, unless earth will retain its position during concreting. All portions of footings above grade must be formed.
- C. Unsuitable Ground: Any errors in structural excavation, soft ground, or clay soils found when excavating shall be reported to Architect. In no case shall work be built on any such soft or clayey unsuitable surface without direction from the Architect. Restore excavations to proper elevation with engineered fill material compacted to 90% of dry density.
- D. Based on geotechnical borings, excavations associated with building foundations, shallow trenches for utilities, and other excavations less than five feet deep associated with the proposed construction, should stand vertically for short periods of time (i.e. less than one day) required for construction. The contractor should be prepared to brace or shore the excavations. Deeper excavations shall be sloped, braced or shored in accordance with Cal/OSHA requirements. Excavated material should not be stockpiled directly near the excavations, nor should excessive equipment traffic along trenches occur to prevent trench wall surcharging.

3.08 SUBGRADE PREPARATION

- A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05' of grades indicated.
- B. After clearing, grubbing and cutting, subsurface shall be plowed or scarified to a depth of at least 12", until surface is free from ruts, hummocks or other uneven features and uniform and free from large clods. Moisture condition per this specification, section 3.08.F. If the existing soils are at a water

content higher than specified, the contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After seven consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the contractor shall notify the architect. If the existing soils have a moisture content lower than specified, the contractor shall scarify, rip, water and blade existing soil to achieve specified moisture content. The contractor shall make proper allowance in schedule and methods to complete this work.

- C. Building Pads and portable buildings pads shall be over-excavated to a depth as needed to achieve the section indicated in section 3.10.
- D. Subgrade in areas to receive landscaping shall be compacted to 90%.
- E. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.
- F. Compaction Requirements for all Earthwork shall be per the following Schedule:

Description	Min. Percent Relative Compaction (per ASTM D1557)	Recommended Minimum Percent Above (or Below) Optimum Moisture Content
Fill Areas, Engineered Fill, Onsite Soil	90	3
Fill Areas, Engineered Fill, Select Fill	90	2
Building Pads, Onsite Soil – Scarified Subgrade prior to Fill	87-92	3
Building Pads, Onsite Soil – Structural General Fill	90	3
Building Pads, Baserock or Select (non-expansive) Engineered Fill	90	± 2
Building Pads – Treated Soil	90	2
Vehicular Pavement, Subgrade, Upper 8"	95	3
Vehicular Pavement, Onsite Soil or Fill (8" or deeper)	90	3
Vehicular Pavement, Class 2 Baserock	95	2
Concrete Flatwork, Subgrade Soil	87-92	3
Concrete Flatwork, Baserock	90	± 2
Underground Utility Backfill	90	3
Underground Utility Trench Backfill, Upper 3' Feet below Existing Pavement Sections (where applicable)	95	3

Or per the recommendations of the soils report, whichever is more stringent.

3.09 PLACING, SPREADING AND COMPACTING FILL MATERIAL IN BUILDING PAD AND PAVEMENT AREAS

- A. Selected fill material shall be placed in layers which, when compacted, shall not exceed 6 inches in compacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity in moisture content.
- B. Selected fill material shall be moisture-conditioned to specified moisture content per section 3.08.F above. Selected fill material shall be unfrozen. When moisture content of fill material is below that

specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading or other methods mentioned in 3.08 B until moisture content is satisfactory.

- C. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted per section 3.08.F above. Compact each layer over its entire area until desired density has been obtained.
- D. Recomposition of Fill in Trenches and Compaction of Fill Adjacent to Walls: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 6", moisture conditioned as listed above, section 3.08.F.
- E. Jetting of fill materials will not be allowed.

3.10 FINAL SUBGRADE COMPACTION

- A. Building Pads: Upper 12" of all final building pad subgrades shall be comprised of native or imported granular non-expansive engineered fill, uniformly compacted at specified moisture content to at least 90% of maximum dry density, as determined by ASTM D1557 Compaction Test, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed. Building pad preparation should extend a minimum 5-foot distance beyond the perimeter of any building footprint, or to the edge of connected outdoor covered areas and adjoining flatwork, whichever is greater.
 - a. As an alternative to the imported non-expansive engineered fill layer noted above, the uppermost 12 inches of pad subgrade may consist of chemically stabilized (lime treated) soil as discussed in Section 31 32 00.
- B. Paved Areas: Upper 12" of all final subgrades supporting pavement sections and all other flatwork shall be native or imported non-expansive granular fill brought to specified moisture content and shall be uniformly compacted per section 3.08.F above, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.
 - a. As an alternative to the imported non-expansive engineered fill layer noted above, the uppermost 12 inches of pad subgrade may consist of chemically stabilized (lime treated) soil as discussed in Section 31 32 00.
- C. Other Fill and Backfill: Upper 12" of all other final subgrades or finish grades shall be compacted to 90% of maximum dry density.
- D. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

3.11 PLACING, SPREADING, AND COMPACTION OF LANDSCAPE BACKFILL MATERIALS

- A. All landscaped areas shall receive topsoil. After subgrade under landscape area has been scarified and brought to 90% maximum dry density, top soil shall be placed evenly to depth of 10" at 85% of maximum dry density.

- B. Project Inspector must verify that materials are uniformly spread to minimum depth specified.

3.12 DECOMPOSED GRANITE COMPACTION AND STABILIZATION

- A. Decomposed granite paving, paths or track shall be placed uniformly to the required depth and treated with PolyPavement or approved equal. Apply PolyPavement using Application Method 1 or a mixed application method.

3.13 SLOPE CONSTRUCTION

- A. Cut slopes shall be constructed to no steeper than 2H:1V (horizontal:vertical). Fill slopes shall be constructed to no steeper than 3H:1V (horizontal:vertical). Prior to placement of fill on an existing slope the existing slope shall be benched. The benches shall be in a ratio of 10 horizontal to 1 vertical. The face of the fill slopes shall be compacted as the fill is placed, or the slope may be overbuilt and then cut back to the design grade. Compaction by track walking will not be allowed.

3.14 FINISH GRADING

- A. At completion of project, site shall be finished graded, as indicated on Drawings. Finish grades shall be "flat graded" to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be $\pm 0.05'$. Tie in new and existing finish grades. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas the finish grade on which it is placed shall be lowered to allow for sod thickness.

- B. All landscape areas shall be left free of rock or foreign material as specified in Section 32 90 00.

- C. All landscape areas shall be approved by Architect prior to any planting.

3.15 SURPLUS MATERIAL

- A. Excavated material not required for grading or backfill shall be removed from site at contractor's expense.

3.16 CLEANING

- A. Refer to Section 01 74 00.
- B. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

END OF SECTION

SECTION 31 13 16

TREE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tree protection complete as shown and as specified.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
1. Section 00 00 00 – Site Demolition.
2. Section 32 80 00 – Irrigation.
3. Section 32 90 00 – Landscaping.

1.2 SUBMITTALS

- A. Contractor shall submit Tree Protection Area plan to Architect outlining all trees and plants listed by number to be protected and their groupings. All trees and plants shall be grouped in their own Fenced Tree Protection Areas as shown in Drawings.
- B. Contractor shall submit to Landscape Architect in writing a schedule including any and all activity inside Fenced Tree Protection Areas. This schedule to include but not limited to the dates fences are initially installed, altered and dates of fence replacement. Intent of these provisions is that the Tree Protection Zone (TPZ) are fenced for the entire duration with only exceptions of short intervals or specifically defined construction activity needs. Revise schedule as directed by Architect.
- C. Provide a Mediation Plan to keep existing trees and planting irrigated during construction.

1.3 WARRANTY

- A. Guarantee all workmanship and materials hereunder against defective workmanship and materials, including damage by leaks and settlement of irrigation trenches, for the duration specified in Division 01 of these Specifications. (The Contractor is not responsible for vandalism or theft after date of final acceptance.)

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials as specified; any deviation from the Specifications must first be approved by the

Owner's Representative in writing. All material containers or certificates shall be clearly marked by manufacturer as to contents for inspection.

- B. Trunk Protection constructed of:
 - 1. 20-foot long 2x6 wood boards or length needed to protect the trunk if tree trunk is shorter than 20'.
 - 2. Metal wire. Gauge strong enough to tie the boards around the trunk of the tree.
- C. Tree Protection Zone Fencing:
 - 1. 4-foot-tall snow fencing or 6-foot-tall metal chain link construction fencing per the discretion of the Landscape Architect or District Representative.
- D. Bark Mulch: Untreated, shredded cedar.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Maintain pre-existing moisture levels.
- B. Maintain areas inside the fenced tree protection area including lawn mowing, leaf removal, operation and repair of irrigation.
- C. Protect root systems from flooding, erosion, excessive watering and drying resulting from dewatering or other operations:
- D. Prohibitions - DO NOT:
 - 1. Allow run off or spillage of damaging materials in vicinity of root systems.
 - 2. Rinse tools or equipment under trees.
 - 3. Store materials, stockpile soil, park or drive vehicles within drip lines or in areas with plants.
 - 4. Cut, break skin or bark, bruise roots or branches.
 - 5. Allow fires under and adjacent trees and plants.
 - 6. Discharge exhaust under foliage.
 - 7. Secure cable, chain, or rope to trees.
 - 8. Change grade within drip line of trees without Landscape Architect's approval.
 - 9. Lime shall not be used.

3.2 INSTALLATION

- A. Tree Trunk Protection
 - 1. Conform to requirements for trees and plants to be retained, per 3.01, above.
 - 2. Install boards vertically around tree and bind together with wire to protect the bark 360 degrees around the entire tree prior to start of any demolition and construction. Boards are

not to dig into bark.

3. Major scaffold limbs may require plastic fencing or straw waddles to be wrapped around them to protect them.

B. Tree Dripline Protection

1. The Tree Protection Zone (TPZ) is a restricted area around the base of the tree with a radius of one foot (1') for every inch of tree trunk diameter or ten feet, which is greater, enclosed by tree protection zone fencing.
2. Signage designating the protection zone and penalties for violations shall be secured in prominent location on each protection fence.

C. Requirements for Trees to be Protected

1. Duration: Tree protection shall be erected before demolition, grading, or any construction begins and remain in place until final inspection of the project.
2. Conform to requirements for trees and plants to be retained, per 3.01, above.
3. Architect shall give final review of Tree Protection before construction to begin. Revise schedule as directed by Architect.
4. Vehicle movement within the TPZ will only be allowed for construction equipment.
 - a. Within dripline, apply 10-inch layer of mulch over geotextile fabric.
5. Perform trenching operations within the TPZ of the tree so that:
 - a. Digging shall be by hand using narrow trenching shovel,
 - b. No roots larger than 2" diameter are cut and utilities are routed around or below them,
 - c. Roots smaller than 2" diameter are cut with sharp tools, saws, loppers- not torn, chopped or broken.
6. Where roots are exposed:
 - a. Do not allow the roots to dry out,
 - b. On the same day the excavation is made, provide temporary backfill to original grade at tree roots,
 - c. Or cover roots with 4 layers of wet untreated burlap, made wet each day, including weekends.
7. Roots larger than 3" in diameter are not to be cut without review and approval of Arborist.

3.3 REPAIR/RESTORATION:

- A. It shall be the responsibility of Contractor to repair or replace any damaged trees.
- B. Repair trees damaged by operations:
 1. within 24 hours of damage,
 2. to satisfaction of Landscape Architect,
 3. to ISA Pruning Standards.

- C. Replace repaired trees where repair has not restored them to health or aesthetics:
1. within 6 months of request to replace,
 2. to the satisfaction of Landscape Architect,
 3. with replacement plants of a size and variety matching those that were removed.
- D. Replaced trees and plants shall be the responsibility of Contractor to maintain in good health and aesthetics for the duration of the project from installation.
1. Contractor shall submit to Landscape Architect comprehensive maintenance plan for replacement tree, including but not limited to provisions for irrigation system independent of existing system.
- E. Where suitable replacement of trees and plants are not available:
1. Contractor shall provide affidavits to Landscape Architect that they are not available.
 2. Contractor shall provide compensation to the State at the following rates:
 - a. \$2000 for each caliper inch of any tree or plants removed under 12 inches.
 - b. \$4000 for each caliper inch of any tree or plants removed 12 inches or more.
 - c. Caliper of trees and plants measured at 6 inches above grade.
 - d. Caliper defined here as thickness of diameter, measured in inches.
- F. Soil Contamination:
1. Contractor shall remove soil that has been contaminated during the performance of the Work by oil, solvents, and other materials which could be harmful to trees and plants, and replace with good soil, at Contractor's expense.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 SUMMARY

A. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 12 00, Asphalt Concrete Paving.
5. Section 32 16 00, Site Concrete.
6. Section 31 25 00, Erosion Control
7. Section 32 80 00, Irrigation.
8. Section 32 90 00, Landscaping.
9. Section 33 40 00, Site Drainage.

1.02 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. Contractor / Installer shall have been in business for five (5) years providing/finishing similar size projects and complexity.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Submit Manufacturers data and shop drawings.

1.04 WARRANTY

- A. Submit fully executed warranty for work and materials in this section per 01 78 36.

1.05 REFERENCES AND STANDARDS

- A. California Building Code current edition.
- B. California Plumbing Code current edition.

- C. Geotechnical Engineering Report: A site specific geotechnical engineering report was and is entitled C.K. McClatchy High School Athletic Field Improvements, prepared on September 15, 2023 by Universal Engineering Services, project number 4630.2300087.0016. This report is on file with Architect. The Geotechnical report is the basis of design of the project and used as a reference in the development of the contract plans and specifications. The Geotechnical report shall be used only as a reference for the soil condition of the project site. The design information contained in the contract plans and specifications shall govern over the recommendation of the Geotechnical report.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Contractor shall acquaint himself with all existing site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.
- B. Field verify that all components, backing, etc. by others are installed correctly to proceed with installation of products as herein specified.
- C. Trench dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for trench dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

1.08 PROTECTION

- A. Adequate protection measures shall be provided to protect workers and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations. Repair all trenches in grass areas with new sod (seeding not permitted) and "stake-off" for protection.
- B. Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Architect or Owner is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullyng of sides of excavation.

- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. Keep all excavations free from water during entire progress of work, regardless of cause, source or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.
- H. Trees: Carefully protect existing trees which are to remain.

1.09 TRENCH SAFETY PROVISIONS

- A. General Contractor shall be solely responsible for safety design, construction and coordination with agencies having jurisdiction. If such plan varies from shoring system standards established by Construction Safety Orders, plan shall be prepared by registered civil or structural engineer.
- B. Nothing herein shall be deemed to allow use of shoring, sloping or protective system less effective than that required by Construction Safety Orders of California State Division of Industrial Safety.
- C. When trenching through paved surface, provide steel trench plates to cover open trenches daily until trenches are backfilled.

1.10 SEASONAL LIMITS

- A. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, full operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.
- B. Material above optimum moisture shall be processed per section 310000, 3.08, B.

1.11 TESTING

- A. General: Refer to Section 01 45 00 – Quality Requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Backfill materials: Pipeline and conduit trench backfill as shown on the plans and as specified below.
 - 1. ¾ inch crush rock.
 - 2. Native Materials: Soil native to Project Site, free of wood, organics, and other deleterious substances. Rocks shall not be greater than ___-inches.
 - 3. Sand: Fine granular material, free of organic matter, mica, loam or clay.
 - 4. Lean Mix Concrete/Controlled Density Backfill: 2 sacks cement slurry.
 - 5. Class 2 aggregate base, ¾" rock, per Caltrans section 26-1.02B

- B. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.
- C. Provide other bedding and backfill materials as described and specified in Section 31 00 00, Section 33 40 00 and Divisions 15 and 16.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verification of Conditions:
 - 1. Examine areas and conditions under which work is to be performed.
 - 2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.

3.02 COORDINATION

- A. General Contractor shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.03 INSTALLATION

- A. Perform work in accordance with pipe manufacturer's recommendations, as herein specified and in accordance with drawings.

3.04 TRENCHING

- A. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of trench around installed item as required for caulking, joining, backfilling and compacting; not less than 12 inches wider than pipe or conduit diameter, unless otherwise noted.
- B. Carefully excavate around existing utilities to avoid unnecessary damage. The contractor shall anticipate and perform hand work near existing utilities as shown on the survey, without additional claims or cost.
- C. Trench straight and true to line and grade with bottom smooth and free of edges or rock points.
- D. Where depths are not shown on the plans, trench to sufficient depth to give minimum fill above top of installed item measured from finish grade above the utility as follows:
 - 1. Sewer pipe: depth to vary
 - 2. Storm drain pipe: depth to vary
 - 3. Water pipe - Fire Supply: 36 inches
 - 4. Water pipe – Domestic Supply: 30 inches
- E. Where trench through existing pavement saw cut existing pavement in straight lines. Grind existing asphalt on each side of trench 3" wide x ½ the depth of the section. Apply tack coat to vertical surfaces before installing new asphalt. Replace asphalt and concrete pavement sections to matched

existing conditions. In concrete pavement provide expansion and control joints to match existing joint layout.

3.05 BACKFILL

A. Pipe Trench Backfill is divided into three zones:

1. Bedding: Layer of material directly under the pipe upon which the pipe is laid.
2. Pipe Zone: Backfill from the top of the bedding to 6 inches (compacted) over the top of the pipe.
3. Upper Zone: Backfill between top of Pipe Zone and to surface of subgrade.

B. Bedding: Type of material and degree of compaction for bedding backfill shall be as defined in the Details and Specifications.

C. Pipe Zone and Upper Zone Backfill:

1. Type of material and degree of compaction Pipe Zone and Upper Zone Backfill shall be as required by Drawings, Details, & Specifications.
2. Upper Zone Backfill shall not be placed until conformance of Bedding and Pipe Zone Backfill with specified compaction test requirements has been confirmed.
3. Backfill shall be brought up at substantially the same rate on both sides of the pipe and care shall be taken so that the pipe is not floated or displaced. Material shall not be dropped directly on pipe.

D. Backfill Compaction:

1. Backfill shall be placed in layers which, when compacted shall not exceed 6 inches in thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity. Do not backfill over, wet, frozen or soft subgrade surfaces. Employ a placement method that does not disturb or damage foundation walls, perimeter drainage, foundation damp-proofing, waterproofing or protective cover.
2. When moisture content of fill material is below that required to achieve specified density, add water until proper moisture content is achieved. When moisture content is above that required, aerate by blading or other methods until specified moisture content is met, see section 310000, 3.08, B.
3. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to 90 % of maximum dry density while at specified moisture content. Compact each layer over its entire area until desired density has been obtained.
4. The top 6 inches of subgrade compaction under pavement or building shall be per Earthwork section 31 00 00.
5. Compaction: All backfill operations shall be observed by the Inspector of Record and/or Geotechnical Engineer. Field density tests shall be made to check compaction of fill material. If densities are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified densities. Notify Inspector and Architect at least 24 hours in advance of any operation.

E. Backfill in Areas Previously Lime or Cement Treated

1. If trenching is necessary in areas that have been previously lime treated the contractor shall backfill the trench with class 2 aggregate base from the top of utility initial backfill up to subgrade in accordance with these specifications. **Lime treated soil may not be re-used once it has been compacted and cured. If re-excavated, it must be disposed of.** In Synthetic track and Synthetic Turf areas, following backfill to subgrade, a 13' wide bridging geogrid, Tensar BX 1100 or Tx140 shall be laid centered over trench on subgrade along entire length of the trench. Geogrid may be waived by the onsite geotechnical engineer based on actual soil conditions.

3.06 TRENCH AND SITE RESTORATION

- A. Finished surface of trenches shall be restored to a condition equal to, or better than the condition as existed prior to excavation work.

3.07 PROTECTION

- A. Protect existing surfaces, structures, and utilities from damage. Protect work by others from damage. In the event of damage, immediately repair or replace to satisfaction of Owner.
- B. Repair existing landscaped areas to as new condition. Replant trees, shrubs or groundcover with existing materials if not damaged or with new materials if required. Replace damaged lawn areas with sod, no seeding will be permitted.
- C. Replace damaged pavement with new compatible matching materials. Concrete walks to be removed to nearest expansion joint and entire panel replaced. Asphalt to be cut neatly and replaced with new materials.
- D. Any existing materials removed or damaged due to trenching to be returned to new condition.

3.08 SURPLUS MATERIAL

- A. Remove excess excavated material, unused materials, damaged or unsuitable materials from site.

3.09 CLEANING

- A. Refer to Section 01 74 00.
- B. Contractor will keep the work areas in a clean and safe condition so his rubbish, waste, and debris do not interfere with the work of others throughout the project and at the completion of work.
- C. After completion of work in this section, remove all equipment, materials, and debris. Leave entire area in a neat, clean, acceptable condition.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENT CONTROLS

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. General: Provide all materials, equipment and labor necessary to furnish and install BMPs and required maintenance as shown on the Drawings and on the Storm Water Pollution Prevention Plan.
- B. Storm Water Pollution Prevention Plan: A Storm Water Pollution Prevention Plan (SWPPP) has been prepared by Warren Consulting Engineers Incorporated (Qualified SWPPP Developer – QSD), and is part of the contract documents. Contractor shall Comply with State Water Resources Control Board requirements. The SWPPP will be provided to the Contractor prior to the start of work. The information provided in the SWPPP shall be used and tailored to the contractor’s approach to the work in this contract. The Contractor shall provide Best Management Practices (BMP’s) during the the following, but not limited to:
 - 1. Cut and fill operations.
 - 2. Temporary stockpiles.
 - 3. Vehicle and equipment storage, maintenance and fueling operations.
 - 4. Concrete, plaster, mortar and paint disposal.
 - 5. Dust control.
 - 6. Tracking of dirt, mud on off-site streets.
 - 7. Pipe flushing.
 - 8. Appropriate Accessory Erosion Controls, deemed necessary by contractor.
- C. General contractor shall provide all monitoring and reporting in accordance with the SWPPP. Contractor shall hire or otherwise acquire a Qualified SWPPP Practitioner (QSP). The QSP shall provide the following, but not limited to:
 - 1. PH and turbidity sampling per current NPDES permit.
 - 2. Upload all AdHoc reports to the SWRCB SMARTS website.
 - 3. Prepare weekly BMP Inspection reports and storm event reports.
 - 4. Prepare Annual Report uploaded to the SMARTS system.
 - 5. Prepare Notice of Termination.

1.2 QUALITY ASSURANCE

- A. General: Comply with governing codes and regulations.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. STRAW WATTLES: Shall be new manufactured straw roles in compliance with state requirements for sediment control.

- B. SILT FENCES: Comply with state and local requirements.
- C. HYDRO SEED MIX: Contractor shall provide a blended seed mix containing both seeds blends and in the following mixture:
 - a. Blando Brome – 12 lbs/acre (0.3 lbs per sf)
 - b. Annual Ryegrass – 9 lbs/acre (0.2 lbs per sf)

Contractor, or Contractor's erosion control specialist or subcontractor may submit an alternative seed mix for review, however, sample projects need to be provided in the greater Sacramento Area that show this mix design is effective.

- D. STRAW HYDROSEED /TACKIFIER: Straw Hydroseed with Tackifier mulch shall be composed of fibers derived from straw products with no growth or germination inhibiting substances. Mulch shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, and water, in the proportions specified, it will form a homogeneous slurry which is capable of being sprayed to form a porous mat. The fibrous mulch in its air-dry state shall contain not more than fifteen percent by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these specifications. Product shall be Hydrostraw™ or equal.
- E. CONCRETE WASHOUT(S): Shall be pre-constructed or built onsite with plastic sheeting and supporting material such as straw bales. Washouts shall be sized for expected concrete work, or multiple washouts provided.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. STRAW WATTLES: Shall be installed per the drawings and/or as required by the SWPPP and Local Authority.
- B. SILT FENCES: Shall be installed per the Drawings and/or as required by the SWPPP and Local Authority.
- C. HYDROSEED AREA: All areas not provided with a permanent surfacing or final landscaping, but is disturbed by grading, construction access, or other construction related means, shall be provided with erosion protective hydroseed as listed below, or other approved method. If existing vegetation significantly re-establishes itself prior to a rain event, as confirmed by contractors QSP, contractor may omit additional stabilizations in this area..
- D.
 - 1. Preparation: Do all slurry preparation at the job site:
 - a. Water, straw mulch w/tacifier, fertilizer, and other ingredients shall be added to the tank simultaneously so that the finished load is homogenous mix of the specified ingredients.

- b. Seed shall be added last and shall be discharged within two hours (2hrs.). Loads held over four hours (4 hrs.) will be recharged with one-half (1/2) the seed rate before application.
- c. Once fully loaded, the complete slurry shall be agitated for three to five minutes (3-5 min.) to allow for uniform mixing.

2. Application:

- a. General: All hydroseed applications are to be applied in a sweeping motion to form a uniform mat at the specified rates.

Two-step Slope Application

Step One

Material	Lbs/Ac
Hydrostraw	2,000
7.2.3 Slow Release Fertilizer	1,000
Seed as per section (2.02 Seed)	#
Am 120 Mycorrhizal Inoculant	60

Step Two

Material	Lbs/Ac
Hydrostraw	2,000

- b. Protection: Contractor is to apply the hydrostraw in such a way as to complete the application in an orderly manner and stay off partially and completely treated areas.
- c. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at Contractor's expense.

3.2 MAINTENANCE AND REMOVAL:

- A. General: Maintain and repair existing and new erosion control facilities throughout the construction period. Remove silt build up at straw wattles and/or silt fences as needed. Repair damage to earth slopes and banks. Erosion control measures shall be left in place until final paving and landscaping are complete.
- B. Monitoring: Contractor's Qualified SWPPP Practitioner shall provide all site monitoring and recommendations to meet current NPDES requirements during construction.
- C. Cleaning: Keep area clean of debris.
- D. Remove erosion control measures prior to placing finish landscaping.

END OF SECTION

SECTION 31 32 00

SOIL STABILIZATION

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Description: Provide Lime/Cement Stabilization Treatment, including spreading and mixing lime and water with in-place materials, and compacting the mixture to the lines, grades and dimensions shown on the plans and/or specified.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 12 00, Asphalt Concrete Paving.
5. Section 32 16 00, Site Concrete.

1.02 SUBMITTALS

A. QUALITY ASSURANCE

1. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
2. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
3. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
4. Tests (See Part 3 for Compaction Testing).
5. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.

6. Failures due to the lack of continuous moisture control during the curing period will be the sole responsibility of the contractor.
7. Any trenching through the finished cured lime/cement section will result in the contractor having to backfill trench with class 2 aggregate base rock, or cement/sand slurry,

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.

1.04 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.05 QUALITY ASSURANCE

- A. General: All Quality Assurance procedures specified on the drawings shall apply to this Section in addition to those shown below.
- B. Testing:
 0. Geotechnical Engineer: Owner is retaining a Geotechnical engineer to determine compliance of Lime/Cement Stabilization Treatment with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except that costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.
- C. Inspection: Work shall not be performed without the physical presence and approval of Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two working days prior to commencement of any aspect of site earthwork.
- D. Field Density: Field density and phenolphthalein reaction tests shall be made by the Geotechnical Engineer after completion of compaction. Where compaction equipment has disturbed the surface to a depth of several inches, density tests shall be taken in the compacted material below the disturbed surface.

1.07 SUBMITTALS

- A. Weighmaster Certificates: Provide certificates as required in Section 2.01B.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Lime/ Cement Treated Engineered Fill: The materials to be treated shall consist of on-site soils or approved import material as described in Section 31 00 00.
- B. Lime/ Cement: Lime/ Cement in areas to be treated shall be a soil admixture of lime and cement, or a multi-spectrum mix such as Quicklime Plus. The percentage of lime shall be based on a soil weight of

110 pcf; hence, 5.0 pounds lime/cement should be utilized per cubic foot. A certification of compliance shall be submitted to the Geotechnical Engineer with each delivery of the lime/cement mixture.

- C. Water: Water shall be added during the preliminary mixing operations and, if necessary, during final mixing and to keep the cured material moist until curing is complete. The amount of water added shall be subject to the approval of the Geotechnical Engineer at all times.

PART 3 - EXECUTION

3.01 PREPARATION

- A. General: Layout all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection facilities; all prior to beginning actual earthwork operations.

3.02 EQUIPMENT

- A. Lime Spreader: The lime/cement shall be spread by equipment which shall uniformly distribute the required amount of lime/cement. The rate of spread per square foot of blanket shall not vary more than 5 percent from the designated rate, unless otherwise approved by the Geotechnical Engineer.
- B. Mixing Equipment: Mixing equipment shall be capable of mixing or remixing the materials to a uniform mixture free of streaks or pockets of lime/cement to the full required depth. Should contractor equipment be unable to mix to the depth specified, contractor shall perform the mixing in multiple lifts, each processed and cured per this specification until the full depth of soil treatment is provided.

3.03 START OF WORK UNDER THIS SECTION

- A. General: Prior to starting physical work under this Section, the property line is to be clearly staked and identified. No lime treated materials shall be allowed to contaminate areas outside of the property.
- B. Utilities; Contractor is to engage with a licensed contractor specialized in the Utility Locating Business. The contractor shall locate any and all utilities and pothole the same. The frequency of potholing shall be enough to establish the elevations of all utilities located.

3.04 LIME SPREADING

- A. Engineered Fill: Provide lime/cement treatment in areas shown on plans and extending a minimum distance of 2 feet from outside edge of curb, wood header, and at least 5 feet beyond the limits of building foundations limits (which may not be the same as the exterior footprint), and to a depth of at least 12 inches beneath building pads and 12 inches beneath flatwork and paving in accordance with Section 31 00 00.
- B. Temperature: Lime shall not be spread while the atmospheric temperature is below 35 degrees Fahrenheit or when conditions indicate that the temperature may fall below 35 degrees Fahrenheit within 24 hours.

3.05 MIXING

- A. Lime/cement shall be added to the material to be treated at a rate of 5.0 pounds lime cement per cubic foot based on a soil unit weight of 110 pcf.
- B. Lime/cement shall be spread by equipment that will uniformly distribute the required amount of lime/cement for the full width of the prepared material. The rate of spread per linear foot of blanket shall not vary more than five percent (5%) from the designated rate.
- C. The spread lime/cement shall be prevented from blowing by suitable means selected by the Contractor. Quicklime shall not be used to make lime slurry. The spreading operations shall be conducted in such a manner that a hazard is not present to construction personnel or the public. All lime spread shall be thoroughly mixed into the soil the same day lime spreading operations are performed.
- D. The distance which lime/cement may be spread upon the prepared material ahead of the mixing operation will be determined by the Geotechnical Engineer.
- E. No traffic other than the mixing equipment and water truck will be allowed to pass over the spread lime/cement until after the completion of mixing. After mixing, grading and compacting are completed, only the water truck is allowed on the treated area to maintain the optimum moisture for curing.
- F. Mixing equipment shall be equipped with a visual depth indicator showing mixing depth, an odometer or footmeter to indicate travel speed and a controllable water additive system for regulating water added to the mixture.
- G. Mixing equipment shall be of the type that can mix the full depth of the treatment specified and leave a relatively smooth bottom of the treated section. Mixing and re-mixing, regardless of equipment used, will continue until the material is uniformly mixed free of streaks, pockets, or clods of lime/cement), and moisture is at approximately two percent (2%) over optimum and the mixture complies with the following requirements:

<u>Minimum Sieve Size</u>	<u>Percent Passing</u>
1-1/2"	100
1"	95
No. 4	60

- H. Non-uniformity of color reaction when the treated material, exclusive of one inch or larger clods, as tested with the standard phenolphthalein alcohol indicator, will be considered evidence of inadequate mixing.
- I. Lime/cement -treated material shall not be mixed or spread while the atmospheric temperature is below 35°F. The entire mixing operation shall be completed within seventy-two (72) hours of the initial spreading of lime, unless otherwise permitted by the Geotechnical Engineer.

3.06 SPREADING AND COMPACTING

- A. The treated mixture shall be spread to the required width, grade and cross-section. The maximum compacted thickness of a single layer may be determined by the Contractor provided he can demonstrate to the Geotechnical Engineer that his equipment and method of operation will provide

- uniform distribution of the lime/cement and the required compacted density throughout the layer. If the Contractor is unable to achieve uniformity and density throughout the thickness selected, he shall rework the affected area using thinner lifts until a satisfactory treated subgrade meeting the distribution and density requirements is attained, as determined by the Geotechnical Engineer, at no additional cost to the Owner.
- B. The finished thickness of the lime-treated material shall not vary more than five hundredths of a foot (0.05') from the planned thickness at any point.
 - C. The lime/cement -treated soils shall be compacted to a relative compaction of not less than ninety-five percent (95%) as determined by the ASTM D1557-01 Compaction Test.
 - D. Initial compaction shall be performed by means of a sheepsfoot type roller or a vibratory padfoot roller. Final rolling shall be by means of a smooth drum roller.
 - E. Areas inaccessible to rollers shall be compacted to meet the minimum compaction requirement by other means satisfactory to the Geotechnical Engineer.
 - F. Final compaction shall be completed within thirty-six (36) hours of final mixing. The surface of the finished lime/cement -treated material shall be the grading plane and at any point shall not vary more than five hundredths of a foot (0.05') foot above or below the grade established by the plans.
 - G. Before final compaction, if the treated material is above the grade tolerance specified in this section, uncompacted excess material may be removed and used in areas inaccessible to mixing equipment. After final compaction and trimming, excess material shall be removed and disposed of off site. The trimmed and completed surface shall be rolled with steel or pneumatic-tired rollers. Minor indentations may remain in the surface of the finished materials so long as no loose material remains in the indentations.
 - H. At the end of each day's work, a construction joint shall be made in thoroughly compacted material and with a vertical face. After a part-width section has been completed, the longitudinal joint against which additional material is to be placed shall be trimmed approximately three inches (3") into treated material, to the neat line of the section, with a vertical edge. The material so trimmed shall be incorporated into the adjacent material to be treated.
 - I. An acceptable alternate to the above construction joints, if the treatment is performed with cross shaft rotary mixers, is to actually mix three inches (3") into the previous day's work to assure a good bond to the adjacent work.

3.07 FINAL GRADING

- A. Finish all lime/cement treated engineered fill grades to within a tolerance of 0.05' of grades shown for top of lime/cement stabilization treatment or as indicated by drawings and specifications.
- B. Leave all areas in suitable condition for subsequent work.
- C. Excess materials not needed for final grading operations shall be removed from the site.

3.07 CURING

- A. The surface of compacted and finish graded lime/cement treated soil shall be kept moist for at least 3 days after final trimming, rolling and compacting. No equipment or traffic shall be permitted on the lime treated material during the 3 day cure, except for the water truck to keep the treated area at or above the optimum moisture. After the 3 day cure apply aggregate base. Maintain moisture curing at optimum level until aggregate base is placed

3.08 LIME REMOVAL

- A. In areas of soil treatment overbuild, per this specification, that encroaches into existing or proposed planting areas, following the treatment compaction and curing of lime, and subsequent placement of base rock and flatwork or asphalt paving, or building foundations, any lime-treated soils shall be re-excavated out of such proposed planting areas and replaced with engineered fill and topped with topsoil in accordance with section 31 00 00 and 32 90 00.

END OF SECTION

SECTION 32 12 00

ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Asphalt paving mix designs.
2. Aggregate Base Course.
3. Asphalt Overlay.
4. Seal Coat and Striping.
5. Tennis Court Asphalt Paving.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 32 12 16.26 Fiber-Modified Asphalt Concrete Paving.
4. Section 31 00 00, Earthwork.

1.03 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
- D. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.
- E. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the contractor.
- F. Sieve analysis from testing laboratories identifying rock/sand percentages within the asphalt mix shall have a testing date within 90 days of contract signing.

- G. Sieve analysis from a testing laboratory identifying rock/sand percentages within the class 2 aggregate base rock shall have a testing date within 90 days of contract signing.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

1.05 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.06 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.08 PROJECT CONDITIONS

A. Environmental Requirements:

1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when atmospheric temperature is below 40 degrees F.
2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50 degrees F.

B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

C. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.

D. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

E. Any construction review of the Contractor's performance conducted by the owner's representative is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

F. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

G. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

H. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

I. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.09 TESTING

A. General: Refer to Section 01 40 00 – Quality Requirements.

B. Geotechnical Engineer: Owner is retaining a Geotechnical Engineer to determine compliance of fill with Specifications, and to direct adjustments in fill operations. Costs of Geotechnical Engineer will be borne by Owner; except those costs incurred for re-tests or re-inspection will be paid by Owner and

backcharged to Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sterilant: Soil sterilizer shall be CIBA GEIGY's Pramamol 25-E or Thompson-Hayward Casoron.
 - 1. Soil sterilizer shall be applied in strict accordance with manufacturer's instructions.
 - B. Base Course Aggregate: State Specifications, Section 26, Class 2 aggregate base (3/4" max.).
 - C. Asphalt Binder:
 - 1. General Paving: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-10. Asphalt binder additives for HMA per Caltrans approved list of manufacturer's.
 - 2. Tennis Courts: Steam-refined paving asphalt conforming to State Specifications, Section 92, viscosity grade PG 64-28M (polymer modified) with FRAC per 32 12 16.26.
 - D. Liquid Asphalt Tack Coat: Per CALTRANS section 94.
 - E. Surface Course Aggregate(s): Mineral aggregates for Type "A" asphalt concrete, conforming to State Specifications 39-2.02, Type A as follows:
 - 1. General asphalt paving:
 - i. 1/2" maximum, medium grading, all lifts.
 - 2. Tennis Courts:
 - i. 3/8" maximum grading surface course asphalt lift.
 - ii. 3/4" maximum grading base course asphalt lift.
- All aggregates used in tennis court paving shall be pyrite free.
- F. Seal Coat: shall be a pre-mixed asphalt emulsion blended with select fillers and fibers such as:
 - 1. "Park-Top No. 302", Western Colloid Products.
 - 2. "OverKote", Reed and Gram.
 - 3. "Drivewalk", Conoco Oil.
 - G. Wood Headers and Stakes: Pressure treated.
 - H. Pavement Marking: Colors as directed by Architect. Colors of painted traffic stripes and pavement markings must comply with ASTM D 6628.
 - 1. Waterborne traffic line - colors white, yellow and red, State specification PTWB-01R3.
 - 2. Waterborne traffic line for the international symbol of accessibility and other curb markings – blue, red and green, Federal specification TT-P-1952F.
 - I. Precast Concrete Bumpers: 3000 psi at 28 day minimum strength; 48" length unless otherwise indicated; provide with steel dowel anchors and concrete epoxy.

- J. Pavement Epoxy; K-Lite; Ktepx-590; Ennis Epoxy HPS2 or an approved equal.
- K. Crack Filler;
 - 1. Cracks up to ½": QPR model CAR08, 10oz asphalt crack filler; Star STA-FLEX Trowel Grade crack filler or approved equal.
 - 2. Cracks ½" – 1": "Docal 1100 Viscolastic, distributed by Conoco, Inc., Elk Grove, CA, (916) 685-9253, or approved equal.
 - 3. Cracks greater than 1": Hot Mix, Topeka.
- L. Reclaimed Asphalt Paugment (RAP). HMA Type A or Type B may be produced using RAP providing it does not exceed 15% of the aggregate blend.
Do not use RAP in Tennis Court paving, only virgin aggregates
- M. Fiber Reinforcement Additives: To be added to asphalt paving mix within all asphalt paving in Tennis Court areas. See Section 32 12 16.26

2.02 MIXES

- A. General: Plant mixed conforming to State Specifications, Section 39, Type B, ½" maximum, medium grading. 3/8" maximum grading shall be used at hardcourt.
- B. Temperature of Hot Mix Asphalt: Not less than 275 degrees F nor more than 325 degrees F when added to aggregate.
- C. Temperature of Hot Mix Aggregate: Not less than 250 degrees F nor more than 325 degrees F when asphalt is added.
- D. Temperature of Hot Mix Asphalt Concrete: Asphalt shall be not less than 285 degrees at time of application, nor more than 350 degrees. Asphalt not meeting the required temperature shall not be used.
- E. Temperature of Warm Mix Asphalt: Mixing and placement; Per the approved manufactures heat range recommendations for mixing and placement.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

- A. Conditions of Work in Place: Subsurfaces which are to receive materials specified under this Section shall be carefully examined before beginning work hereunder, and any defects therein shall be reported, in writing, to the Architect. Work shall not be started until such defects have been corrected. Starting of work shall imply acceptance of conditions as they exist.

3.02 PREPARATION

- A. Sub-Grade: Clean, shape and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be

verified immediately prior to placement of aggregate base. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

- B. Cleaning: Existing surfaces and new surface shall be clean of all dirt, sand, oil or grease. All cracks shall be cleaned and free of all debris and vegetation. Hose down entire area with a strong jet of water to remove all debris.

3.03 INSTALLATION

A. Headers:

1. General: Install as edging to asphalt paving, except where adjoining existing pavement, concrete curbs, walks or building.
2. Existing Headers: Remove existing headers where new paving will join existing. Saw cut existing asphalt to provide clean edge.
3. Lines and Levels: Install true to line and grade. Cut off tops of stakes 2-inches below top of header so they will not be visible on completion of job.

B. Asphalt Paving:

1. Aggregate supporting Base: Install in accord with State Specifications, Section 26. Compact to relative compaction of not less than 95%, ASTM D1557. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have sufficient moisture which, in the opinion of the Architect is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.
 - a. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.
2. Sterilant: Apply specified material at manufacturer's recommended rate. Applicator of sterilant material shall be responsible for determining location of all planter areas. Apply specified material over entire base course area just prior to application of asphalt. Follow manufacturer's printed directions.
3. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed.
4. Asphalt Concrete Base and Surface Courses:
 - a. Comply with State Specifications, 39-6 except as modified below:
 - 1) Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities, with a minimum density of 91% of the theoretical maximum specific gravity determined by California Test Method #309. Maximum variation 1/8 inch in 10' when

measured with steel straightedge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. In no case shall accessible parking spaces or loading and unloading areas exceed 2% slope in any direction.

- 2) Asphalt material shall be delivered to the project site in a covered condition to maintain acceptable temperature. Onsite inspector shall verify temperature of asphalt upon truck arrival to the site.
- 1) Fiber Reinforcement Additives: To be added to asphalt paving mix within all asphalt paving in Tennis Court areas. See Section 32 12 16.26.
- b. At Tennis Courts, following base course AC installation and grinding and patching of portions existing asphalt to remain, contractor to check the planarity on a 10' grid. AC shall not exceed 1/8" variance from design in 10 feet. Contractor shall provide additional grinding in high spots and a thin layer of hot topeka mix to fill low spots until a uniform base is achieved. Contractor shall water test to find any ponding water locations and repair as above. After all imperfections are repaired, contractor may continue with final surface course AC lift. Any surface imperfections following the final lift of AC shall be repaired with the acrylic court surfacing products in accordance with manufacturers recommendations.
5. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.
6. Water Testing: All paved areas shall be water tested, to check drainage, in the presence of the project inspector prior to placement of seal coat. The surface of asphalt paving shall not vary more than 1/8 inch above or below the grade established on the plans. If variations in grade are present, they will be corrected by overlaying paving and/or pavement removal and replacement as directed by the Architect.
7. Patching: Cut existing paving square and plumb at all edges to be joined by new paving. In trenches; grind existing asphalt on each side of trench 3" wide x 1/2 the depth of the section. Apply tack coat to vertical surfaces before installing new work. Warp carefully to flush surface, with seal over joints, and feather edge. Sawcut, remove and patch existing paving where cutting is necessary for installation of piping or conduits under Divisions 2, 15 and 16.

C. Seal Coat:

1. Seal coat shall be applied no sooner than 30 days from time of asphalt placement, no exceptions.
2. **DO NOT APPLY SEALCOAT IN TENNIS COURT PAVING AREAS.** Refer to section 32 12 33.1 for Tennis Court Surfacing.
1. Surface Preparation: surface and cracks shall be clean of all dirt, sand, oil or grease. All cracks shall be filled to a level condition after curing. Make multiple fill applications until a level condition is achieved. Failure to do so will be the reason for rejection. Hose down entire area with a strong jet of water to remove all debris. Remove soft, loose, or otherwise damaged areas of asphalt concrete to

full depth of damage and replace with compacted hot mix asphalt concrete as specified herein. Minor holes and imperfections may be patched using hot mix asphalt or mastic using sand/SS-1-H. Use wire brush for removal of oil and grease; prime with shellac or synthetic resin as recommended by manufacturer of pavement sealer material.

2. Seal Coat Seal Application: Thoroughly mix materials and apply in the presence of the onsite inspector. Failure to do so will be cause for rejection. Apply in accordance with manufacturer's written instructions.
 - a. The minimum application rate for each applied coat shall be 30gals per 1000 sq. ft. Two coats of sealcoat will be required.
 - b. Clean-Up and Precautions: As recommended by pavement sealer material manufacturer.
- D. Asphalt Concrete Overlay Paving:
1. Comply with State Specifications, 39-6 except as modified below.
 2. Grind or remove existing asphalt concrete paving at limits of overlay paving to provide a minimum 1 1/2" overlay thickness. Limits of grinding or removal shall be field verified to insure that finished paving surface will have a one percent minimum slope.
 3. Thoroughly clean surface to remove vegetation, dirt, sand, gravel and water from surface and from cracks. Vegetation shall be treated 7 days prior to removal with an herbicide.
 4. Cracks greater than 1 inch shall be filled with hot mix asphalt and rolled and compacted. Cracks less than one inch shall be filled with crack filler. Potholes shall be filled with hot-mix rolled and compacted. Contractor shall have Engineer approve crack and pothole repair prior to overlay. Provide leveling courses of hot mix asphalt as required to achieve finish grades shown on the drawings.
 - a. Cracks less than one inch in width shall be level after curing. Contractor shall make multiple filling applications as necessary to achieve a level condition.
 5. Place overlay when ambient air temperature is 40 degrees F. and rising, and when pavement is dry.
 6. An asphalt tack coat shall be applied to existing surface area at a rate of 0.20 gallons per square yard. Application width shall be width of fabric plus 2 to 6 inches.
 7. Place, spread and compact asphalt overlay to provide a minimum density of 95% of maximum theoretical unit weight as determined by California Test Method #304. Maximum variation 1/8" in 10' when measured with steel straight edge in any one direction. Test paved areas for proper drainage by applying water to cover area. Correct portions that do not drain properly by patching with plant mix. Minimum compacted overlay thickness 1 1/2 inches.
 8. At Tennis Courts, overlay shall be 3/8" surface course AC as listed herein.
- E. Pavement Marking: pavement markings shall be done only after the seal coat has thoroughly dried. Existing surfaces to be striped with traffic paint shall be cleaned of dust, dirt, grime, oil, rust or other

contaminants which will impair the quality of work or interfere with proper bond of paint coats. Surfaces shall be thoroughly cleaned by whatever means necessary that will satisfactorily accomplish the purpose without damage to asphalt concrete. Provide measured layouts, temporary markings, templates, and other means necessary to provide required marking. Prepare and apply paint in accordance with manufacturer's instructions; paint shall be applied by spray and shall achieve complete coverage free from voids and thin spots. Where indicated on the Drawings, paint parking stall strips, lettering, arrows, accessible symbols, playfield markings, etc. on asphalt concrete paving. Paint strips shall be 4 inches wide (except otherwise indicated) and applied with two (2) coats of herein specified Traffic Line Paint; white (except as otherwise specified or indicated).

1. Paints shall be delivered to the site in unopened containers:
 - a. Paint shall not be diluted, or watered down.
 - b. Paint shall be applied in 10-12 wet mil thickness (4-6 mil dried). Each coat thickness shall be verified by the project inspector.
2. International Accessible Symbol: Symbol shall be white figures on a blue background. Blue shall be equal to PMS 293C. Lines and symbols shall be accurately formed and true to line and form; lines shall be straight and uniform in width. Painted edges shall be clean cut and free from raggedness, and corners shall be cut sharp and square. Tolerances: Apply striping within a tolerance 1/2 inch in 50 feet. Apply markings and striping to widths indicated with a tolerance of 1/4 inch on straight sections and 1/2 inch on curved sections.

F. Colors: As directed by Architect

G. Precast Concrete Bumpers: Install in location where shown, using steel rebar dowels, and epoxy.

3.04 DEFECTIVE ASPHALT;
Defective asphalt is as described below.

- A. Exposed rock pockets on the finished surface that lack the # 8- #200 fines that is required per the sieve analysis.
- B. Asphalt not placed to the design grades.
- C. Asphalt that ponds water.
- D. Asphalt that was compacted below the minimum required temperature and is cracked.
- E. Asphalt that fails to meet the minimum compaction requirements.
- F. Asphalt that lacks the minimum thickness required per plan.
- G. New asphalt contaminated by a petroleum product, or spilled paint.
- H. Asphalt that has depressions, cracks, scored divits from dumpster wheels, heavy equipment use, heavy construction products,
- I. Asphalt placed on pumping, unstable sub-grades.

J. Asphalt that is not flush with adjoining flush curbs, concrete aprons or flatwork (tolerance shall be 1/8").

3.05 CLEANING

A. Refer to Section 01 74 00.

B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

C. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION

SECTION 32 12 16.26**FIBER REINFORCED ASPHALT CONCRETE (FRAC) TENNIS COURTS****PART 1 - GENERAL****1.01 SCOPE OF WORK**

- A. This work shall consist of providing and placing FRAC in accordance with these specifications and lines, grades, thicknesses and typical cross-sections shown in the plans. Furnish all materials, equipment, labor and incidentals for mixing fiber in hot mix asphalt (HMA), when fiber is required as a mixture ingredient. Paving FRAC shall be in accordance with these specifications as well as those outlined in section 302-5 of these and the standard specifications, whichever is more stringent.

1.02 DEFINITIONS

- A. Reinforcing Fibers: High tensile strength aramid fiber blend specially formulated to reinforce hot mix asphalt.
- B. Fiber Reinforced Asphalt Concrete (FRAC): A mixture of hot or warm mix asphalt and reinforcing fibers that has greater resistance to rutting, thermal cracking, fatigue cracking, and reflective cracking as compared to conventional non-fiber asphalt mixes.
- C. Fiber Reinforced Asphalt Rubber Hot Mix (FR-ARHM): A mixture of rubberized asphalt and reinforcing fibers that has greater resistance to rutting, thermal cracking, fatigue cracking, and reflective cracking as compared to non-fiber rubberized asphalt mixes.
- D. Aramid Dispersion State Ratio (ADSR): A measure of the dispersion efficiency of the Reinforcing Fibers within asphalt mixes. ADSR is calculated by comparing the mass of aramid in the individual state to the total mass of extracted aramid fibers, expressed as a percentage.

1.03 REFERENCES

- A. ASTM D2172, Standard Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
- B. ASTM D6433, Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys.
- C. AASHTO T322, Determining the Creep Compliance and Strength of Hot-Mix Asphalt (HMA) Using the Indirect Tensile Test Device.
- D. AASHTO TP79, Standard Method of Test for Determining the Dynamic Modulus and Flow Number (FN) for Asphalt Mixtures Using the Asphalt Mixture Performance Tester.
- E. Zeiada, W., Underwood, S., Stempihar, J., "Extraction of Aramid Fibers from Fiber Reinforced Asphalt Concrete – Special Test Method", Arizona State University, May 11, 2016.

1.04 SUBMITTALS:

Submit the following as part of the bid package:

- A. Representative fiber product sample.
- B. Fiber product data sheet and certification from the Manufacturer that the fiber product supplied meets the requirements of this specification.
- C. Manufacturer’s instructions and general recommendations.
- D. Performance results of ADSR testing from a minimum of three separate laboratory trials to validate Dispersion Efficiency.
- E. Performance results of PCI testing from a minimum of three separate field trials to validate Cracking Resistance.
- F. Performance results of FN testing from a minimum of three separate laboratory trials to validate Rutting Resistance.

****NOTE: Testing is NOT required on samples from the job mix, submit previously completed lab testing only.**

Submit a minimum of five unique project examples and references where the reinforcing fiber product was used within 250 miles of the project location.

PART 2 - PRODUCTS

2.01 MATERIAL PERFORMANCE:

Reinforcing Fiber Properties

1. Provide a reinforcing fiber blend of Virgin Polyolefins and Virgin Aramids that meets the requirements in Table 1 and Table 2 below.

Table 1

Reinforcing Fiber Material Properties			
Property	Test Method	Polyolefin	Aramid
Form	Manufacturer Certification	Serrated	Monofilament
Nominal Specific Gravity	ASTM D276	0.91	1.44
Tensile Strength (psi)	ASTM D7269	NA ¹	400,000
Length (in)	Manufacturer Certification	0.75	0.75

1. Polyolefin fibers will melt or become plastically deformed during production

Table 2

Reinforcing Fiber Performance Properties			
Performance Measure	Test Method	Standard	Requirement
Dispersion Efficiency	Aramid Dispersion State Ratio (ADSR)	Modified ASTM D2172	≥ 85%

Field Performance Cracking Resistance	Pavement Condition Index	ASTM D6433	≥ 10 PCI Points Increase, Minimum 4 Years
Resistance to Permanent Deformation (Rutting)	Flow Number (FN)	AASHTO TP79	≥ 75% increase

- a. FORTA-FI®, provided by the Forta Corporation, is an acceptable product and meets the performance and material properties outlined in this section.
- b. FORTA-FI fiber reinforcement, HMA blend
 - Manufacturer:
 FORTA Corporation
 100 N. Forta Drive
 Grove City, PA 16127
 (800) 245-0306
www.forta-fi.com
 - Technical Contact:
 Mike Hass
 Pacific Geosource
 10779 SW Manhasset Dr
 Tualatin, OR 97062
 (503) 214-0376
mhass@pacificgeosource.com
- c. If a different aramid-based fiber blend is proposed, performance test results complying with Section D.2 below must be submitted at least two weeks prior to bid date for approval by engineer.
- d. Non-aramid fiber blends will not be considered as acceptable alternatives to this specification.
- e. Non-aramid fiber blends, aramid fiber blends with dosages less than 1 pound per ton, or fiber ton equivalents will not be accepted.

2.02 PERFORMANCE TESTING REQUIREMENTS

All historical test results submitted to validate the fiber’s performance in asphalt mixes shall be from previously completed laboratory and field trials using plant-produced FRAC from a documented source only. Results from lab-produced FRAC or FRAC from an undocumented source will not be accepted. **Testing is NOT required on samples from the job mix.**

Fiber dosage rate in all submitted test reports must be equal to the rate proposed for this project. Only testing performed by an AASHTO accredited laboratory or nationally recognized university testing lab will be considered.

- 1. Aramid Dispersion State Ratio (ADSR) Tests from a minimum of three (3) separate laboratory trials.
 - a. Perform ADSR test based on modified ASTM D2172 procedures as provided in the document entitled “Extraction of Aramid Fibers from Fiber Reinforced Asphalt Concrete – Special Test Method”. A copy of the modified extraction methodology can be obtained by making an inquiry to the Pavement and Materials Laboratory at Arizona State University at NCE@asu.edu.

- b. To validate ADSR results, average extracted aramid fiber quantity must equal 0.007 percent by total sample weight with no individual result less than 0.005 percent of the total sample weight.
 - c. All tested fiber mixes must achieve a minimum ADSR of 85%.
2. Pavement Condition Index (PCI) side by side comparison from a minimum of three (3) field trails with a minimum in-service pavement age of four years.
- a. PCI surveys shall be performed according to ASTM D6433.
 - b. Tests results shall include a control and a fiber reinforced pavement section. FRAC mix shall be identical to control mix except for the inclusion of fibers added at the same dosage as proposed on the project.
 - c. In field performance sections shall be subject to the same environmental and traffic conditions. A minimum surface area of 500 yd² per FRAC and control section is required.
 - d. PCI results from fiber sections shall show a minimum 10 PCI points greater than the control section after a minimum of 4 years.
3. Flow Number (FN) Tests from a minimum of three (3) separate laboratory trials.
- a. Perform FN tests using the protocol from AASHTO TP79.
 - b. Tests results shall include a control and a fiber reinforced mix. FRAC mix shall be identical to control mix except for the inclusion of fibers added at the same dosage as proposed on the project.
 - c. Results from fiber specimens shall each show an average FN increase of at least 75% over control specimens.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

Add aramid and polyolefin reinforcing fiber blends at a dosage rate of one (1) pound fiber per one (1) ton of asphalt. Non-aramid fiber blends, aramid fiber blends with dosages less than 1 pound per ton, or fiber ton equivalents will not be accepted. Add alternative aramid fiber blends that achieves the ADSR, PCI, and FN results required by Section 302-15.2. Have a fiber manufacturer's representative on site during mixing and production. This requirement can be waived if fiber manufacturer and asphalt producer can supply evidence of manufacturer's brand of fiber being successfully produced a minimum of three times at the asphalt plant to be used for the project.

3.02 JOB MIX FORMULA REQUIREMENTS

Store, mix and produce the fiber reinforced ACP mixture in accordance with the following requirements:

1. Deliver fiber-reinforcement in sealed, undamaged containers with labels intact and legible, indicating material name and lot number.
2. Deliver fiber-reinforcement to location where it will be added to each batch or loaded into the mixer.
3. Store materials covered and off the ground. Keep sand and dust out of boxes and do not allow boxes to become wet.
4. Add aramid and polyolefin reinforcing fiber blends at a dosage rate of one (1) pound fiber per one (1) ton of asphalt. Non-aramid fiber blends, aramid fiber blends with dosages less than 1 pound per ton, or fiber ton equivalents will not be accepted.

5. Have a fiber manufacturer's representative on site during mixing and production. This requirement can be waived if fiber manufacturer and asphalt producer can supply evidence of manufacturer's brand of fiber being successfully produced a minimum of three times at the asphalt plant to be used for the project.
6. Batch Plant. When a batch plant is used, add fiber to the aggregate in the weigh hopper and increase both dry and wet mixing times. Ensure that the fiber is uniformly distributed before the injection of asphalt cement into the mixture.
7. Drum Plant: a. Inject fibers through the RAP collar with a metered air blown system to promote rapid and complete fiber dispersion. Rate the feeding of fibers with the rate the plant is producing asphalt mix. If there is any evidence of fiber bundles at the discharge chute, increase the mixing time and/or temperature or change the angle of the fiber feeder line to increase dry mixing time. b. Add fibers continuously and in a steady uniform manner. Provide automated proportioning devices and control delivery within $\pm 10\%$ of the mass of the fibers required. Perform an equipment calibration to the satisfaction of the fiber manufacturer's representative to show that the fiber is being accurately metered and uniformly distributed into the mix. Include the following with the air blown system:
 - Low level indicators
 - No-flow indicators
 - A printout of feed rate status in pounds/minute
 - A section of transparent pipe in the fiber supply line for observing consistency of flow or feed.
 - Manufacturer's representative's approval of fiber addition system

3.02 DELIVERY STORAGE AND HANDLING

Deliver fiber-reinforcement in sealed, undamaged containers with labels intact and legible, indicating material name and lot number.

Deliver fiber-reinforcement to location where it will be added to each batch or loaded into the mixer.

Store materials covered and off the ground. Keep sand and dust out of boxes and do not allow boxes to become wet.

3.03 PLACEMENT

Follow manufacturer's and engineer's recommendations for placement of FRAC.

3.04 QUALITY CONTROL

1. Aramid Dispersion Visual Test: Collect a 10kg sample of mix from the discharge chute during first 50 tons of production. Visually assess the state of aramid fibers in the sample as "Pass" or "Fail" as described below.
 - i. "Pass" = All fibers exist in an Individual State and no Undistributed Clips or Agitated Bundles of fiber are detected.
 - ii. "Fail" = One or more Undistributed Clips or Agitated Bundles are detected.

2. If a sample is rated as "Fail", adjust mixing operations to improve fiber dispersion and repeat Step 1 above.
3. If Visual Test results in three consecutive "Fail" ratings, contact the fiber manufacturer for corrective measures.
4. In addition to Visual Test, use a shovel to inspect FRAC mix in the back of first three trucks and every tenth truck thereafter to confirm adequate blending of the fiber.
5. Remove any observed fiber bundles from placed mixture and adjust operations per the manufacturer's recommendation to eliminate future fiber bundle development, and repeat Steps 1 through 3 above to confirm adequate aramid fiber dispersion.

Manufacturer Certification Buy-American:

1. Provide manufacturer notarized certification that aramid fibers and any other materials used in conjunction with the fibers are 100% American made and manufactured.

3.05 PAVING PATCHING AND REPAIR

- A. Paving Patching and Repair: All paving that is damaged due to trenching, etc., or that is damaged due to construction under this Contract, shall be repaired and/or replaced hereunder as determined by Architect with new paving and base. All work shall be in accordance with the applicable material and application requirements specified herein.
 1. Saw cut existing asphalt concrete paving at all areas indicated or required for new construction work and at edges of paving to be replaced and remove debris from the site. Excavation work and removal of material and backfill below bottom of base shall be the responsibility of the trade involved in the work.

3.06 TESTING

- A. Complete surfacing shall be thoroughly compacted smooth, true to grade and cross section, free from ruts, humps, depressions or irregularities. After the surfacing has been placed the entire area shall be tested for proper drainage by applying water in sufficient amount to cover the surface. If any portion fails to drain properly, the condition shall be corrected by patching with asphalt concrete until correction of improper drainage is completed.
 1. No ponding water is acceptable on new paving or adjacent areas caused by new work.
- B. The District will employ an accredited independent testing Laboratory to sample materials, perform tests, and submit test reports during and after paving placement.
- C. A 24" long SMART Level will be used for all measurements by percent of slope and cross slope to determine compliance.

3.07 PROTECTION

FIBER REINFORCED ASPHALT CONCRETE PAVED TENNIS COURTS

32 12 00- 7

- A. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than six (6) hours.
 - 1. Provide barricades and warning devices as required to protect pavement.

[END OF SECTION 32 12 16.26]

SECTION 32 12 33.1

SPORT COURT SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Specification Section 32 12 16 "Asphalt Paving."

1.2 DESCRIPTION OF WORK

- A. Extent of sport court surfacing is shown on the drawing plans and details.
- B. Installation of surfacing material over asphalt paving to provide an evenly textured, colored surface for sport courts.

1.3 SUBMITTALS

- A. Material Certificates: Provide copies of materials certificates certifying each material complies with, or exceeds, specified requirements.
- B. Reference list from the installer of at least 5 projects of similar scope done in each of the past 3 years.
- C. Product substitution: If other than the product specified, the contractor shall submit a complete type written list of proposed substitutions with sufficient data, drawings, samples and literature to demonstrate to the owner and architect's satisfaction the proposed substitution is of equal quality and utility to that originally specified. Information must include a QUV test of at least 1000 hours illustrating the UV stability of the system. The color system shall have an ITF pace rating in Category 2.

1.4 SITE CONDITIONS

- A. New asphalt installation shall cure a minimum of 14 days prior to applying surfacing products.
- B. Review asphalt pavement surface, base, edge restraints and construction are in sound condition prior to applying surfacing products. Notify Owner in event asphalt is not acceptable for repairs.
- C. Review asphalt surface is smooth, uniform and slopes toward drainage structures with minimal bird baths and minimal imperfections prior to applying surfacing products. Notify Owner in event surface is not acceptable for minimal repairs. Beginning of surface application shall indicate acceptance and approval of asphalt installation.

1.5 QUALITY ASSURANCE

- A. The installer shall be an “authorized applicator” of the specified system and shall be regularly engaged in construction and surfacing of acrylic play courts or similar surfaces. Contact DecoTurf (978) 623-9980, www.californiasportssurfaces.com.
- B. The manufacturer’s representative shall be available to help resolve material questions.
- C. The contractor shall provide the inspector, upon request, an estimate of the volume of each product to be used on the site.
- D. The contractor shall record the batch number of each product used on the site and maintain it through the warranty period.
- E. Surfacing shall conform to the guidelines of the American Sports Builders Association for planarity.

1.6 MATERIAL HANDLING AND STORAGE

- A. Deliver product to the site in original unopened containers with proper labels attached.
- B. All surfacing materials shall be non-flammable.
- C. Do not store products in sun.
- D. Do not allow products to freeze during storage or transit.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Crack filler – Deco Crack Filler 64061, highly flexible, ready-to-use, high solids, rubberized acrylic filler. For use on minor, non-structural cracks, less than ½”.
- B. Surface Imperfections – Deco Acrylic Patch Binder 920-39, high strength acrylic latex bonding liquid specifically designed for field mixing with Portland cement and silica sand to patch new or existing asphalt and Portland cement concrete recreational surfaces. The resulting patch is hard, tough and durable. Patch binder intended to fill voids and depressions from 1/8” to 1 ½” deep. Do not use in lifts greater than ¾”.
- C. Acrylic Resurfacer – Deco Acrylic Resurfacer 920-29, a concentrated 100% acrylic latex binder designed for field mixing with Silica Sand to be applied to recreational surfaces constructed of hot-mix asphalt or Portland cement concrete. Do not use sand containing clay, silt, ferrous metals or salt.
- D. Acrylic Color Texture Course – DecoColor surfacing system containing DecoBase 1, 920-05, a sand filled, 100% acrylic latex compound designed for squeegee application to relatively smooth surfaces, supplied as a non-pigmented concentrate to be pigmented with DecoColor

MP Classic, 920-27 and diluted with clean potable water. DecoBase1 results in a dense, durable textured surface and adds firm thickness to the color system, designed to impart the texture that controls the speed of play, provides a tough, wear-resistant coating and consistent texture across the playing field. Design mix for medium speed of play.

- E. DecoColor Finish Course – DecoColor Mp Classic 920-27, a full bodied, high performance acrylic latex coating, fortified with specially selected fillers and pigmented in one of eleven standard colors. DecoColor is intended for use as a texture and/or top coat for recreational surfaces. Silica sand selection shall consist of 60-90 mesh sand. Do not use sand containing clay, silt, ferrous metals or salt. Submit sand samples to the California Products Research and Development laboratory for analysis and approval before incorporating into mixture. Colors shall be selected by Owner’s Representative from standard colors.
1. Tennis court lines to be 2” wide white lines.
 2. Tennis court surface to be “Royal Blue.”
 3. Tennis court perimeter to be “Forest Green.”
 4. Confirm colors with Owner’s Representative prior to placing order.

PART 3 - EXECUTION

3.1 SURFACING WEATHER LIMITATIONS

- A. Do not install when rainfall is imminent or extremely high humidity prevents drying.
- B. Do not apply unless surface and air temperature are 60°F and rising.
- C. Do not apply if surface temperature is in excess of 140°F.

3.2 SURFACE PREPARATION

- A. Clean: Power wash, clean, scrape and remove loose material, oily materials, chemical residues, vegetation and other debris or foreign matter that may prevent proper product adhesion or cause an imperfect surface.
- B. Crack Filling:
 1. Thoroughly rout existing cracks of dirt, debris and loose impediments. Cracks should be blown clean with an air compressor.
 2. After cleaning, apply Deco Crack Filler 64061 to fill cracks. Crack filler comes ready-to-use, only gently stirring is necessary. Do not dilute. Fill cracks by hand with a square, snub-nosed hand trowel or broad knife with a narrow bead of material along the crack.
 3. After the crack filler has been forced into the crack, the edges shall be wiped clean with a damp cloth to prevent edge build-up which would require sanding as a corrective measure.
 4. After drying, edges shall be sanded smooth and loose material shall be carefully removed by air-broom and/or sweeping.
- C. Surface Imperfections:

1. Flood court surface with water and allow to drain. Any depressions capable of submerging a U.S. five-cent piece after one hour should be marked with chalk, not crayon or grease pencil.
2. Allow to surface to dry thoroughly.
3. The following mixture ratio is intended for average surface conditions: 100 lbs. dry silica sand (60-80 mesh) with 1 to 2 gallons Portland cement (Type I), and 3 gallons Deco Acrylic Patch Binder 920-39.
4. In a clean container, thoroughly premix the sand and Portland cement concrete. Add Acrylic Patch Binder into mixture. Use a mechanical drill mixer to stir ingredients until homogeneous. Periodic mixing should take place as job progresses to ensure consistent application. Batches shall be used within 15 minutes.
5. Do not install Acrylic Patch Binder mix in lifts greater than 3/4". Acrylic Patch Binder is intended for patching voids and depressions from 1/8" to 1 1/2" deep.
6. Install Acrylic Patch Binder using a trowel or straight edge. The area to be patched should first be primed with a diluted coat of Acrylic Patch Binder. Do not dilute more than 2 parts water to 1 part Acrylic Patch Binder. The mixture should be brushed, broomed or rolled over the entire area and allowed to dry at least 1 hour.
7. Pour the Acrylic Patch Binder mix over the area to be patched and trowel into place. Edges of the patch should be "feathered" so as not to leave a ridge of material around the patch. Ridges should be removed with a scraper prior to a thorough cure. Once cured, an additional coat of diluted Acrylic Patch Binder may be applied and allowed to dry.
8. Acrylic Patch Binder must be allowed to dry before applying next coating application. When applying multiple coats of Acrylic Patch Binder, a minimum of 24 hours of cure time is required between coats, and not before first application is fully dried.

3.3 ACRYLIC RESURFACER

- A. Obtain approval of surface preparation from project inspector in writing prior to proceeding.
- B. The following mixture ration is intended for average surface conditions: 55 gallons Acrylic Resurfacer, 600-900 pounds Silica Sand (60-80 mesh) and 20-40 gallons clean, potable water.
- C. Undiluted coverage rate is approximately 0.06 gallons per square yard per application.
- D. In no case should Acrylic Resurfacer be diluted more than three (3) parts Acrylic Resurfacer to tow (2) parts water. The quantity of water required will vary with moisture content and gradation of the sand and the consistency needed for good application characteristics.
- E. After the addition of sand and water to the Acrylic Resurfacer concentrate, thorough mixing is required. A mechanical drill mixer is recommended and mixture should be stirred until homogeneous. Periodic mixing should take place as the job progresses to ensure consistent application.
- F. Contractor shall apply two (2) coats of Acrylic Resurfacer mixture. Using a flexible rubber squeegee, apply Acrylic Resurfacer mix parallel to one of the sides of the court area. Care should be taken not to leave ridges where adjoining applications overlap. Application in hot

conditions is improved by keeping surface damp with a fine mist water spray. Never allow water to pool on the surface. Additional applications should be installed at 90 degrees to the previous application.

- G. Acrylic Resurfacer Mix must be allowed to cure a minimum of two (2) hours before applying additional coatings.

3.4 ACRYLIC COLOR TEXTURED COURSE

- A. The following mixture ratio is intended for average surface conditions: 55 gallons DecoBase 1 920-05, 15 gallons DecoColor MP 920-27 and 23 gallons clean potable water.
- B. Mix ingredients in a clean container. After addition of water, thorough mixing is required. Use a mechanical drill mixer to stir ingredients until homogeneous. Periodic mixing should take place as job progresses to ensure consistent application.
- C. Contractor shall apply two (2) coats of Acrylic Texture.
- D. Using a flexible rubber squeegee, 50 or 70 durometer, apply DecoBase 1 mix parallel to one of the sides of the court area. Care should be taken not to leave ridges where adjoining applications overlap. Application in hot conditions is improved by keeping surface damp with a fine mist water spray. Never allow water to pool on the surface. Additional applications should be installed at 90 degrees to the previous application.
- E. DecoBase 1 must be allowed to dry four (4) hours before another coating can be applied, assuming 79 degree Fahrenheit temperatures and 50% relative humidity. Low temperatures and high humidity will increase drying time dramatically.
- F. Coverage rate of undiluted product shall be approximately 0.06 gallons per square yard, per application (150 square feet per gallon).

3.5 DECOCOLOR FINISH COURSE

- A. Finish Course shall consist of two (2) texture course applications and one (1) finish course application.
- B. Mixture proportions for texture course shall consist of 55 gallons DecoColor MP Classic 920-27, 27 gallons clean potable water and 440 pounds silica sand (60-90 mesh).
- C. Mixture proportions for finish course shall consist of 55 gallons DecoColor MP Classic 920-27 and 39 gallons of clean potable water.
- D. When mixing, sand should be slowly added to undiluted DecoColor MP followed by the addition of water. A mechanical mixer is recommended and mixture should be stirred until homogeneous. Periodic mixing should take place as the job progresses to ensure consistent application.
- E. Using a flexible rubber squeegee, 50 or 70 durometer, apply DecoColor MP Texture Course mix parallel to one of the sides of the court area. Care should be taken not to leave ridges

where adjoining applications overlap. Application in hot conditions is improved by keeping surface damp with a fine mist water spray. No pooling should be allowed. Additional applications should be installed at 90 degrees to the previous application. Repeat procedure for second coat DecoColor MP Texture Course mix and again for DecoColor MP Finish Course mix.

- F. Undiluted rate of application is approximately 0.04 gallons per square yard, per application (180 square feet per gallon).
- G. Do not over-dilute. The maximum dilution ratio for the Texture Course is two (2) parts DecoColor to one (1) part water. The maximum dilution ratio for the Finish Course is three (3) parts DecoColor to two (2) parts water. Over-dilution will cause streaking, foaming, adhesion failure, sand fall-out and poor overall durability of the coating.

3.6 PROTECTION

- A. Erect temporary barriers to protect coatings during drying and curing.
- B. Lock gates to prevent use until acceptance by the owner's representative.

3.7 CLEAN UP

- A. Remove all containers, surplus materials and debris. Dispose of materials in accordance with local, state and Federal regulations.
- B. Leave site in a clean and orderly condition.

END OF SECTION

SECTION 32 15 40
CRUSHED STONE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

- A. The extent of work in this Section includes the provision and installation of the following paving materials, base foundations and appurtenances required for installation.
- B. The general extent of work for this Section is shown on the drawings and includes, but is not limited to, the following:
 - 1. Infield Fines.
 - 2. Header Board.
 - 3. Aggregate Base.

1.3 QUALITY ASSURANCE:

- A. All manufactured items shall be inspected and approved upon delivery.
- B. Protect from damage and intrusion of deleterious materials during delivery, handling, storage, and installation.
- C. Materials Source: Sources of materials specified herein shall not be changed during the course of work without review and written acceptance by the Owner's Representative.

1.4 SUBMITTALS:

- A. Contractor shall submit a one (1) quart sample indicating variation of size and color of the following:
 - 1. Infield fines mixture.
 - 2. Infield clay mixture.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Store stone paving material in a secure location. Coordinate with General Contractor for available stockpile location.

1.6 PROJECT CONDITIONS:

- A. Protection of Work: Protect work from trespass until paving has cured.

PART 2 - PRODUCTS

2.1 SAND AND CLAY MATERIALS:

A. Suppliers:

1. Sand: TMT Enterprises, Inc., San Jose, CA (408) 432-9040 as specified unless otherwise noted, or equal. Contact: Matt Moore.
2. Fines and Clay: Ewing Irrigation and Landscape Supply, Sacramento, CA (916) 383-2400 as specified unless otherwise noted, or equal. Contact: Jim Barbuto.

B. Infield Fines and Clay Mix:

1. Mix shall be free of rocks, debris, vegetation, clay balls, foreign materials, etc. Infield mixes shall be sterilized to eliminate the possibility of any growth of vegetation.
2. Infield Fines: "DuraEdge Infield Fines" by DuraEdge Products, Inc. or equal.
 - a. The composition of the mix shall be achieved using mechanical blending equipment prior to delivery to the site and shall be as follows:
 - 1) Total sand content shall be 70-75 percent.
 - 2) The combined amount of sand retained on the medium, coarse and very coarse sieves shall be greater than or equal to 50 percent.
 - 3) The combined amount of silt and clay shall be 25-30 percent.
 - 4) The ratio of silt divided by clay, otherwise known as the SCR, shall be 0.5 – 1.0.
 - 5) No particles greater than 3 millimeters.
 - 6) Equal to or less than 5 percent of particles shall be retained on the 2 millimeter.
3. Warning Track: "DuraTrax CO Lava Warning Track" by DuraEdge Products, Inc. or equal.
 - a. Warning Track shall be clean, crushed red lava rock resulting in a mix that is red in color, having a yield of approximately 0.9 tons per cubic yard and possessing the following particle size analysis:

Sieve Size	Range of % Passing
3/8"	100
No. 4	90-100
No. 8	60-80
No. 16	45-60
No. 30	30-50
No. 50	20-35
No. 100	10-25
No. 200	5-15

4. Pitcher's Mound Mix: 100 percent, high-density pure virgin clay; "DuraPitch ProLoc Block" by DuraEdge Products, Inc. or equal.
 - a. Color: Reddish brown.

- b. Pitching mound and batter's box clay is pre-compressed clay blocks that are reddish brown in color and possessing the following particle size analysis:
 - 1) Total sand content shall be less than 15 percent.
 - 2) The overall clay/silt content shall be greater than 85 percent.
 - 5. Home Plate and Bases Clay: 100 percent pure virgin clay blocks; "DuraPitch ProLoc Block" by DuraEdge Products, Inc. or equal.
 - a. Color: Reddish Brown.
 - b. Pitching mound and batter's box clay is pre-compressed clay blocks that are reddish brown in color and possessing the following particle size analysis:
 - 1) Total sand content shall be less than 15 percent.
 - 2) The overall clay/silt content shall be greater than 85 percent.
 - 6. Bases Clay: "TMT Pro-Grade Screened Clay."
- C. Sports Field Conditioner: ProSlide Calcined Clay Conditioner as supplied by DuraEdge Products, Inc., or equal.
- D. Aggregate Base: Shall be coarse aggregate for regular weight concrete. Aggregate shall be hard, durable, uncoated, graded, cleaned and screened crushed rock or gravel conforming to Class II aggregate base per Caltrans Standard Specifications. Crusher-run stone or bank-run gravel will not be permitted.

PART 3 - EXECUTION

3.1 AGGREGATE BASE ROCK

- A. Install Class II aggregate base rock to depth and compaction as detailed on Drawings.
- B. Place aggregate in maximum 6-inch layers and compact to specified density.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- G. Tolerances:
 - 1. Flatness: Compaction testing will be performed in accordance with ASTM D1557.
 - 2. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.2 INFIELD CLAY MIX AT HOME PLATE AND BASES

- A. Home Plate: Excavate evenly designated infield areas and lay a ½ - inch course of loose clay and compact. Lay clay bricks across entire area and alternate brick joints in courses. Bricks to be worked together to bond and hand tamp. Apply ½-inch layer of loose clay to cover and finish with fines layer.
- B. Bases: Excavate evenly designated infield areas and lay loose clay in 2-inch lifts and compact. Lay additional lifts to achieve 4-inches of clay and compact.
- C. Water lightly and compact with 1,000 to 3,000-pound roller.
- D. Spread additional material, roll and compact to establish even finished grade at specified elevation.

3.3 INFIELD FINES AND WARNING TRACK MIX

- A. Spread infield fines mix evenly where shown in drawings and screed in 2-inch lifts. Thoroughly water each lift until the entire depth is moist.
- B. Roto-till specified sports field conditioner into the top 3-inches of fines at a rate of 1.0 ton per 1,000 square feet.
- C. Compact with a 1,000 to 3,000-pound roller after grading and wetting final lift.

3.4 SPORTS FIELD CONDITIONER

- A. As specified for infield fines mix.

3.5 PITCHER'S MOUND MIX

- A. Apply the pitcher's mound clay mix at 2-inch lifts, tamp, compact and repeat.
- B. Compact with a 1,000 to 3,000-pound roller after grading and wetting final lift.
- C. Fill in back and sides of sloping to the edge of the circle.

3.6 TOLERANCES

- A. Vertical deviation from the specified lines, grades and detail cross sections shall not exceed 0.04 foot for all surfacing specified in this Section.

END OF SECTION

SECTION 32 16 00

SITE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. The Section describes the requirements for providing portland cement concrete paving, including accessibility ramps, sidewalks, accessible routes of travel, vehicular travel, drain structures, sewer structures, thrust blocks and for other non-structural or non-vehicular applications.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 00 00, Earthwork.

1.02 REFERENCES AND STANDARDS

- A. California Building Code, latest edition.
- B. ACI Standards, ACI 211.1, ACI 318-14, ACI 302, IR-04, ACI 301-16, ACI 305R-10, ACI 306R-16, ACI 308-16.
- C. ASTM C-94, Specification for Ready-Mixed Concrete.
- D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).
- E. ASTM – American Society for Testing and Materials.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- C. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.

- D. With concrete submittal, provide documented history of mix design performance.

1.04 QUALITY ASSURANCE

- A. Use only new materials and products.
- B. Use materials and products of one manufacturer whenever possible.
- C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.
- B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.
- C. Transport, store and handle in strict accord with the manufacturer's written recommendations.
- D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.
- E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.
- F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.06 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.07 TESTING

- A. General: Refer to Section 01 40 00 – Quality Requirements.
- B. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and DSA.

1.08 ADEQUACY AND INSPECTION

- A. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.
- B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.09 PROTECTION

- A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.10 FIELD MEASUREMENTS

- A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement: Portland cement, ASTM C150, Type II, per ACI 318-14 Section 26.4.
- B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.
- C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 318-14 Section 26.4.1.3.1.
- D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.
- E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Admixture shall conform to ASTM C494 and ACI 318-14 Section 26.4.1.4.19(a). Such admixture must receive prior approval by the Architect, Structural Engineer, and the Testing Lab, and shall be included in original design mix.
- F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318-14, section 26.4.1.4.
- G. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.
- H. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.
- I. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing

- sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.
- J. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3'-0" O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3" concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.
 - K. Truncated Domes: Vitriified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; "Armor-Tile", "Access Tile Tactile Systems", or approved equal. Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B (dome spacing shall be 2.35"). Install tiles as recommended by manufacturer. Color, federal yellow (FS 33538).
 - L. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing compound meeting ASTM C 309 and C1315.
 - M. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.
 - N. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.
 - O. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed, non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.
 - P. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.
 - Q. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.
 - R. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893.
 - 1. Reference Standard: ASTM C920, Grade P, Class 25, Use T.
 - 2. Dow Corning 890-SL (self-leveling) Silicone, or accepted equal.
 - 3. Dow Corning 888-NS (non-sagging) Silicone, at slopes exceeding 5%. May not be used at asphalt surfaces.
 - 4. Color: Custom color as selected by Architect.
 - S. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8" "Snap Cap", Tex-Trude expansion joint cap, or an approved equal.
 - T. Adhesive Anchoring (Epoxy): Hilty HIT-HY 200 Safe Set, or approved equal.
 - U. Striping: See section 32 12 00.

2.02 CONCRETE DESIGN AND CLASS

- A. Class "B": Concrete shall have 1" max. size aggregate, shall have 3500 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.
- B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".
- C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ASI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.
- D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.03 MIXING OF CONCRETE

- A. Conform to requirements of CBC, Chapter 19A.
- B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.
- C. Concrete shall be Ready-mixed Concrete: Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301. Batch Plant inspection may be waived in accordance with CBC Section 1705A.3.3.1, when approved by Structural Engineer and DSA.
 - 1. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
 - 2. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
 - 3. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.
 - 4. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished conforms in every particular and to proportions established by mix designs.
 - 5. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
 - 6. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.04 MATERIALS TESTING

- A. Materials testing of concrete and continuous batch plant inspection may be waived in accordance CBC Sections 1704A.4.4 when approved by Structural Engineer and DSA.

- B. Testing of concrete shall be performed per article 3.12 of this specification.

2.05 EQUIPMENT

- A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 - EXECUTION

3.01 APPROVAL OF FORMS AND REINFORCEMENTS

- A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given to DSA, Architect and Structural Engineer 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.
- B. All reinforcing steel shall be adequately supported by approved devices on centers close enough to prevent any sagging.
- C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.
- D. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.
 - 1. The bars shall be placed so that there will be a minimum of 1 ½" clearance and a maximum of 3" clearance. The reinforcing steel shall be placed mid-depth of concrete slab.
- E. At all right angles or intersections of concrete walks, additional 2'x2' #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2" from concrete forms and supports at mid-depth of slab.

3.02 PROTECTION

- A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.
- B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.
- C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05' in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.03 CLEANING

- A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or

any other coatings that would impair bond to concrete.

- B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.04 FORMING

- A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.
- B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.
- C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.
- D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.
- E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.
- F. Slope tie-wires downward to outside of wall.
- G. Brace, anchor and support all cast-in items to prevent displacement or distortion.
- H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.
- I. Concrete paving, Curbs, Curb and Gutters, Ramps:
 - 1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20' for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.
 - 2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60' on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
 - 3. Isolation Joints: 3/8" felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
 - 4. Exterior Concrete Paving: Install expansion joints at 20' on center maximum, both directions, unless shown otherwise on plans.
 - 5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.

- a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
- b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.05 FORM COATING

- A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.
- B. Before re-using form material, inspect, clean thoroughly and recoat.
- C. Seal all cut edges.

3.06 INSTALLATION

- A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.
- B. Placing Tolerances:
 1. Per ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.
 2. Clear distance between parallel bars in a layer shall be no less than 1", the maximum bar diameter not 1 ½ times the maximum size of coarse aggregate.
- C. Splices:
 1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
 - a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56" minimum for No. 6 bars. No. 4 bar shall have a minimum of 24" splice. 93 bar diameters for No. 7 bars and larger.
 - b. All splices shall be staggered at 5 feet minimum.

3.07 INSPECTION

- A. Approval of reinforcing steel, after installation, must be received from Inspector. Architect, Structural Engineer and DSA must be notified 48 hrs. in advance of beginning of concrete placement operations.
- B. Slope of concrete forms and finish condition shall be checked with a two foot (2') digital level.

3.08 PLACING OF CONCRETE

- A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.
- B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.
- C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.
- D. Remove form spreaders as placing of concrete progresses.
- E. Place footings as monolithic and in one continuous pour.
- F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.
- G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.
- H. Concrete Flatwork:
 - 1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be true and flat with a maximum tolerance of 1/8" in 10' for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.
 - 2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
 - 3. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.
 - 4.
- I. Placing in hot weather: Comply with ACI 305R-10. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.
- J. Placing in cold weather: Comply with ACI 306R-16. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall

have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.

- K. Horizontal construction joint: Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.09 CONCRETE FINISHES

- A. Concrete Slab Finishing: Finish slab as required by ACI 302.1R. Use manual screeds, vibrating screeds to place concrete level and smooth. Use "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate below the surface leaving a thick layer of mortar 1 inch in thickness. Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:
 - 1. Flatwork, medium broom finish: Typical finish to be used at all exterior walks and stairs.
 - 2. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
 - 3. Under no circumstances can water be added to the top surface of freshly placed concrete.
- B. Curb Finishing: Steel trowel.
- C. Joints and Edges: Mark-off exposed joints, where indicated, with 1/4" radius x 1" deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.
 - 1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.
- D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed, shall be sacked with a grout mixture of 1-part cement, 1 1/2- parts fine sand and sufficient water to produce a consistency of thick paint. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a time, then wiped or rubbed with dry burlap. Entire finishing operation of any area shall be completed on the same day. This treatment shall be carried to 4" below grade, and all patching and sacking shall be done immediately upon removal of the forms.

- E. Stair Treads and Risers: Tool exterior stair tread nosing per ADA requirements and as detailed. Paint or stain tooled area at every stair tread nosing or as detailed. Stair tread nosing shall contain no pockets, voids or spalls. Patching is not allowed. Damaged nosing shall be replaced.

3.10 CURING

- A. Cured Concrete in Forms: Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.
- B. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations.
 - 1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.
- C. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

- A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.
- B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.
- C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.
- D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.
- E. Defective concrete is:
 - 1. Concrete that does not match the approved mix design for the given installation type.
 - 2. Concrete not meeting specified 28-day strength.
 - 3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
 - 4. Concrete which is incorrectly formed, out of alignment or not plumb or level.

5. Concrete containing embedded wood or debris.
 6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
 7. Concrete not containing required embedded items.
 8. Excessive Shrinkage, Traverse cracking, Cracking, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
 9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
 10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
 11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
 12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
 13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.
- F. Patching: Install specified Patching Mortar per manufacturer's recommendations. REPAIRS TO DEFECTIVE CONCRETE WHICH AFFECT THE STRENGTH OF ANY STRUCTURAL CONCRETE MEMBER OR COMPONENT ARE SUBJECT TO APPROVAL BY THE ARCHITECT AND DSA.

3.12 CONCRETE TESTING

- A. Comply with CBC Section 1903A, 1905A.1.16, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.
- B. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.
- C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.
- D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
- E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.
- F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

- A. Remove without damage to concrete surfaces.

- B. Sequence and timing of form removal shall insure complete safety of concrete structure.
- C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
 - 1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
 - 2. Slab edge screeds or forms: 7 days.
 - 3. Concrete columns and beam soffits: 28 days.
- D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 PAINTING AND STRIPING

- A. See Section 32 12 00 for striping materials and application.

3.15 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean excess material from surface of all concrete walks and utility structures.
- D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION

SECTION 32 18 13

SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.

1.02 DESCRIPTION OF WORK

- A. The extent of work in this Section includes the provision and installation of the following synthetic grass paving materials, base foundations and appurtenances required for installation.
- B. The general extent of work for the Section is shown on the Drawings and includes, but is not limited to, the following:
 - 1. Synthetic grass surfacing (also referred to as Synthetic Turf).
 - 2. Foam cushion.
 - 3. Base preparation and installation.
 - 4. Nailing board.
 - 5. Perimeter concrete curb.

1.03 QUALITY ASSURANCE:

- A. All manufactured items shall be inspected and approved upon delivery.
- B. Coordinate all work with the work of other sections to avoid delay and interference with other work.
- C. Protect from damage and intrusion of deleterious materials during delivery, handling, storage, and installation.
- D. Installer's Qualifications:
 - 1. Successful experience in installation of synthetic grass surfacing of similar type to that specified, with a minimum of 25 projects completed within last 5 years.
 - 2. Employ persons trained for installation of playground safety surfacing.
 - 3. The synthetic grass installer shall have minimum experience of at least 5 years, actively selling, installing and maintaining in-fill synthetic turf project of similar size.
 - 4. The synthetic grass installer must provide a list of references based on previous installations.
 - 5. Installation team shall be established, insured installation firm experienced as a premium turf installer with suitable equipment and supervisory personnel, with a minimum of 5 years' experience with 15 foot wide tufted materials.

1.04 REFERENCES

- A. Related Sections:

1. 32 1313.1 Concrete Work (Landscape).
- B. ASTM Standard Test Methods:
 1. ASTM F1951-99 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.
 2. ASTM D 2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
 3. ASTM F 1292 - Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
 4. US Consumer Product Safety Commission (CPSC) Handbook for Playground Safety.

1.05 SITE INSPECTION

- A. The inspection shall include a check for planarity. The finished surface shall not vary from a true plane more than 1/4" in 10 feet when measured in any direction. The Contractor shall provide all required tools and materials needed for the planarity check, which may include but not be limited to, a laser level, string line, straight edge and/or other assessment materials. The Contractor shall mark in the field any deviations from grade in excess of those specified above, as well as provide a marked up plan locating the deviations. The Contractor shall correct any deviations to the satisfaction of the Engineer and Synthetic Turf installer.
- B. The compaction of aggregate base shall be 95% to Standard Proctor and surface tolerances shall not exceed 1/4" over 10 feet.
- C. The Contractor shall have a state registered surveyor conduct an elevation survey of the area in a 25' grid to determine and verify that subgrade elevations and slopes are within the previously specified tolerances. This elevation survey may require further verification of smaller areas within the 25' grid if determined necessary by the Owner's Representative.
- D. When any or all corrective procedures have been completed, the finished sub-base surface must be re-inspected, with the same representatives attending the initial inspection. If required, additional repair and inspections are to be conducted until the subbase surface is deemed acceptable by the Owner's Representative and Synthetic Grass installer.
- E. Commencement of work under this section shall constitute acceptance of the work completed under other sections, including acceptance of dimensions of the subbase.

1.06 ENVIRONMENTAL CONDITIONS

- A. Install synthetic turf surfacing only when ambient air temperature is 35 F or above and the relative humidity is below 35% or as specified by the product manufacturer. Installation will not proceed if rain is imminent.
- B. Install product only when prepared base is suitably free of dirt, dust, and petroleum products, is moisture free and sufficiently secured to prevent unwanted pedestrian and vehicular access.
- C. Maintain all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

1.07 QUALITY CONTROL

- A. Prior to the beginning of installation, the Synthetic Turf Installer shall inspect the subbase. The installer will accept the sub-base in writing when the general contractor provides test results for compaction, planarity and permeability that are in compliance with the synthetic turf manufacturer's recommendations and as stated herein.
- B. Remove defective Work, whether the result of poor workmanship, defective products or damage, which has been rejected by the Engineer as unacceptable. Replace defective work in conformance with the Contract Documents.
- C. It is the installer's responsibility to ensure that U.S. Product Safety Guidelines, ADA and referenced ASTM standards are complied with on playgrounds prior to installation, such as, but not limited to, safety fall zones are sufficient and fall heights are met.

1.08 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and color samples for review and selection.
- B. Test Reports: Submit certified test reports from qualified independent testing agency indicating results of impact attenuation testing.
- C. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.
- D. Warranty: Submit manufacturer's standard warranty.
- E. Copy of manufacturer issued installation certification.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Inspect material in ensure nothing is broken, open or missing upon delivery to the project site. Adhesives shall arrive in dry, sealed containers.
- B. Storage:
 - 1. Store materials in accordance with manufacturer's instructions.
 - 2. Adhesive: Store adhesive in a dry area at a minimum temperature of 50 degrees F (10 degrees C).
 - 3. Store products in a location and in a position that protects them from crush damage or any other defects.
- C. Handling: Protect materials during handling and installation to prevent damage and to safely to ensure their physical properties are not adversely affected and that they are not subject to vandalism or damage.

1.10 WARRANTY – synthetic turf

- A. The Contractor shall provide a minimum fifteen (15) year warranty policy by the manufacturer, against defects in materials and workmanship. Manufacturer warrants that if the synthetic grass it manufactured and supplied proves to be defective in materials or workmanship resulting in premature wear, during normal use of the product, within fifteen

(15) years from the date of manufacture, or suffers significant fading, breakdown or degradation due to exposure to natural ultraviolet rays within the same fifteen (15) year period, Manufacturer will, at its sole option either 1) repair or replace the affected area without charge to the Purchaser, or 2) issue a credit equal to the cost of the synthetic grass material. For the purpose of this warranty the product shall be deemed to have failed in ultra-violet stability if the original tensile strength of the product decreases by more than 50 percent.

- B. Proration is as follows: years 1-8 (100%), years 9-12 (50%), years 13-15 (25%).
- C. In the event Manufacturer elects to issue a credit in lieu of repair or replacement, said credit shall only apply to the affected area of the synthetic grass giving rise to the claim. The credit shall be issued to the Retailer, as a percentage of the replacement cost of new synthetic grass of the same or comparable quality. The credit will be good only toward the purchase of Manufacturer's synthetic grass. There will be no cash payment.
- D. Warranty does not cover any type of matting product.
 - 1. WARRANTY DOES NOT COVER ANY TYPE OF MATTING ON THIS PRODUCT, REGARDLESS OF THE CAUSE.
 - 2. This warranty only applies to synthetic grass products that have been purchased from Synthetic Grass Warehouse (SGW).
 - 3. This warranty is limited to the remedies of repair or replacement of the affected areas of the synthetic grass.
 - 4. This warranty does not cover the installation of the synthetic grass or any issues stemming from the installation.
 - 5. This warranty does not cover surface deterioration resulting from normal wear and tear or any damages caused by site conditions and improper installation beyond its control, accidents, misuse, abuse, neglect, exposure of the Product to inappropriate footwear (i.e. metal cleats), tobacco products, chemicals or cleaning agents, fire, floods, vandalism, acts of God.
 - 6. SGW HEREBY DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND DISCLAIMS LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.
 - 7. SGW SPECIFICALLY EXCLUDES AND WILL NOT PAY CONSEQUENTIAL OR INCIDENTAL DAMAGES UNDER THIS WARRANTY. This includes any damages arising out of or in connection with the use or performance of the synthetic grass, including, but not limited to damages for economic loss, expense, personal injury etc.
 - 8. This warranty is non-transferable. This warranty is only extended to the original purchaser.
 - 9. All warranty claims must be presented in a timely fashion to SGW as a printed description with photos as soon as an issue with the synthetic grass becomes evident.
 - 10. This warranty does not cover sun magnification and melting from Low E windows or matting.

PART 2 - PRODUCTS**2.01 TURF SYSTEM**

- A. Tiger Turf – Diamond Pro Fescue, or approved equal.
1. Manufactured by TigerTurf New US Ltd. (800) 464-0477, available through Synthetic Grass Warehouse (SGW), info@tigerexpresslandscape.com.
 2. Contact local sales representative:
JoAnn Eleopoulos: 1400 N. Daly Street
Anaheim, CA 92806
(714) 683-2050
Email: Joann@SGWCorp.com
 3. Turf blades shall be 1.875 inch pile polyethylene monofilament with thatch construction, colors Field Green/Olive Green. Turf shall be designed specifically for landscape application.
 4. Synthetic turf products shall be lead free, non-toxic and contain no RCRA hazardous waste heavy materials. Shall be UV stabilized, have no harmful environmental effects, and be non-flamable, ant-acid yarn resistant to chemical attack.
 5. TigerTurf products meet the requirements for the American Society for Testing Materials F1292 certification. This testing certifies each of these products achieve the criteria for G-Max (shock) in addition to the Head Injury Criterion score, which measures the impact severity quantifying the risk of head trauma.
 6. Product Manufacturer shall be a member of The International Play Equipment Manufacturers Association (IPEMA), a non-profit membership trade association. This organization serves all playground equipment industry manufacturers and provides third-party product certification services for American public play equipment and surface materials. IPEMA promotes safety and in-depth information regarding issues affecting the playground equipment and surfacing industry. Product shall be certified IPEMA to ASTM F1292.
 7. Yarn characteristics:
 - a. Type: Monofilament PE with thatch
 - b. Composition/structure: Polyethylene.
 - c. Denier: 10,800/5,000
 - d. Colors: Field Green/Olive Green
 8. Turf characteristics:
 - a. Pile/Face Weight: Approximately 75 ounces
 - b. Pile height: Approximately 1.875 inches
 - c. Maching Gauge: 3/8 inch
 - d. Thatch Color: Brown
 9. Manufactured Rolls:
 - a. Width: 15 feet
 - b. Length: 100 feet.
 - c. Shipping weight: 1209 pounds (approximate weight)
 - d. Roll diameter: 24 inches
 - e. Total product weight: approximately 116 ounces per square yard.
 10. Particulate Infill:
 - a. Type: Quality infill

- b. Weight: 3.5-4.5 pounds per square foot (approximately)
 - c. Height: Approximately .5 inch to .75 inch
 - d. Colors: Green.
 - e. For IPEMA Certification, infill must be 2 pounds of Wonderfill 12/20 per square foot.
11. Drainage rate:
- a. 30+ inches of rain per hour per square yard.

2.02 SYNTHETIC GLUE MATERIAL

- A. Adhesive products shall be Nordot 34G, Mapei 2K, Turf Claw, hot melt technology or approved equal.
- B. Any adhesive products required for the installation of a proposed turf system shall be purpose-suited to the system. The material and application methods shall be as recommended by the adhesive manufacturer.
- C. Disposal of adhesive containers and unused adhesives as well as any fees resulting from such disposal shall be the responsibility of the Contractor.

2.03 FOAM PAD

- A. Schmitz Foam Products, ProPlay-Sport20 shock pad, 20 millimeter thick, puzzle shape edges for interlocking pads and no glue required, with vertical drainage characteristics. Contact local representative Gary Carr at (208) 720-7266, g.carr@schmitzfoam.com.
 - 1. The XPE foam flakes shall be sourced from clean post-industrial (pre-consumer) waste.
 - 2. The XPE foam flakes shall be closed-celled; the bonding of the XPE foam flakes shall be open to water infiltration.
 - 3. The XPE foam flakes shall be thermally bonded to a PES spunbond textile, with a mass of 70 g/m².
 - 4. The shock pad shall be manufactured in panels of 7.5' x 3.08'
 - 5. The shock pad sheets shall contain expansion slots (to the plane), to take in thermal expansion.
 - 6. The shock pad shall meet or exceed all performance properties listed in TABLE 1 of this section.

Physical characteristics	Tolerance	ProPlay® Value	Unit	Standard
Thickness at 2 kPa (0.3 psi) load	+/- 1	20	mm	EN-ISO 9863-1*
Mass per unit area	+/- 0.23	2.3	kg/m ²	EN-ISO 9864*
Required characteristics International Sports Associations				
	Tolerance	ProPlay® Value	Unit	Standard
Tensile strength	> 0.15	0.26	MPa	EN 12230
Tensile strength after (air) ageing acc. EN 13817				
	> 0.15	0.25	MPa	EN 12230

Water infiltration rate [IA]	> 180	72,000	mm/h	EN 12616
Performance characteristics		ProPlay® Value	Unit	Standard
Force reduction		60	%	AAA**
Energy restitution		48	%	AAA**
Vertical deformation		8.1	mm	AAA**
Shock absorption		61	%	EN 14808
Vertical deformation		6.6	mm	EN 14909
Critical fall height (Head Injury Criterion ~ 1000)		0.68	m	EN 1177
Thermal resistance (R-value)		0.40	m ² .K/W	EN 12667

- 2.04 HEADERBOARD/PERIMETER NAILING BOARD: Recycled plastic nominal 2" by 4" continuous Bend-a-Board or equal.
- 2.05 CONCRETE PERIMETER PAVING: Refer to 32 1313.1 Concrete Work (Landscape).
- 2.06 CLASS 2 PERMEABLE AGGREGATE BASE ROCK: Recycled permeable product composed of ¾" crushed concrete and minimal fine stones allowing it to be water permeable, meeting CalTrans specification for permeable class 2 base rock., available from Lyngso Garden Materials, Inc., (650) 364-1730, www.lyngsogarden.com.
- 2.07 ¼" MINUS QUARRY FINES: Graniterock or equal crushed granite. Material shall be ¼" minus and well graded to provide compaction and contain no large aggregate. Contact Southside Sand & Gravel (831) 630-3200.
- 2.08 PERFORATED DRAIN PIPE: Perforated drain pipe to be schedule 40 PVC 1120 Type 1 Grad 1 per ASTM D-1784, white in color, 20' in length with belled ends. Perforations shall consist of two (2) rows of holes, 120 degrees apart, parallel to the axis of the pipe, ½" diameter holes space five (5) inches on center.
- 2.09 FILTER FABRIC: Filter fabric shall be Mirafi 140-N, from Tencate Geosynthetics, non-woven geotextile fabric composed of polypropylene fibers, formed in a stable network to retain their relative position, shall resist naturally encountered chemicals, alkalis and acids, meeting AASHTO M288 Class 3 for Elongation > 50%.
- 2.10 DRAIN ROCK: Drain rock shall be ¾" crushed drain rock available from Lyngso Garden materials, Inc., www.lyngsogarden.com, (650) 364-1730.

PART 3 - EXECUTION

3.01 GENERAL

- A. Installation of the synthetic turf system is to comply with the manufacturer's recommendations, requirements and the reviewed and approved shop drawings.

- B. Perform all work in strict accordance with the Contract Documents and the manufacturer's specifications and instructions. Only those skilled technicians proposed in the bid phase are to be assigned to this project by the Contractor.
- C. The designated Supervisor for the Synthetic Turf Installer must be present during any and all construction activity associated with the field installation, including testing, cleanup and training.
- D. All products and equipment are to be from sources approved by the authorized turf manufacturer and conform to the specifications.

3.02 PERFORATED DRAIN PIPE

- A. Install 4" diameter or 6" diameter (refer to civil Drawings for exact size) perforated drain pipe as detailed, wrapped in drain rock and filter fabric.
- B. Slope to drain at 1% minimum slope.
- C. Extend and connect perforated drain pipe to storm drain system.

3.03 CLASS II AGGREGATE BASE ROCK

- A. Class II permeable aggregate base rock shall be carefully placed and compacted over the subgrade to the grades and elevations shown on the drawings. If the thickness of the planned bottom rock exceeds 6 inches, the rock shall be placed in horizontal layers not exceeding 6 inches and each layer compacted to 92 percent relative compaction with a vibratory smooth drum roller.
- B. Install drain rock over the perforated drain pipe channel, minimum 12" wide area, as detailed to allow for drainage.
- C. Should any segregation of the material occur, during any stage of the stockpiling, spreading or grading, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further separation.
- D. Final base rock grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.08 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is recommended.
- E. The top surface of the bottom rock shall be sloped as shown on the drawings.
- F. Base rock grades shall be completed by the Contractor and inspected by the Owner's Representative prior to commencing with the subsequent work items.

3.04 ¼" MINUS QUARRY FINES

- A. The quarry fines shall be carefully placed using a self-propelled paving machine in order to minimize segregation.
- B. Should any segregation of the material occur, during any stage of the work, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further segregation.

- C. The finished surface shall be compacted to 92 percent relative compaction with a vibratory smooth drum roller to provide a non-yielding, smooth, flat surface.
- D. Final quarry fines grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.02 feet in 10 feet in any direction. Laser grading is recommended.
- E. The top surface of the quarry fines shall be sloped as shown on the drawings.
- F. All quarry fines grades shown on the drawings shall be completed by the Contractor and inspected by the Owner prior to commencing with the subsequent work items.
- G. A small trial area (15 feet square, minimum) of quarry fines shall be installed prior to installing the complete surface. The Contractor's Synthetic Turf Installer shall observe the placement and compaction of quarry fines in the trial area and determine whether the surface is suitable to install the synthetic turf. The Contractor shall modify installation procedures and/or material used until the Contractor's Synthetic Turf Installer is satisfied.
- H. Field percolation testing shall be conducted by the Contractor. The Contractor shall correct the quarry fines layer, at no cost to the Owner, if the minimum percolation requirement is not achieved.

3.05 FOAM CUSHION INSTALLATION

- A. The Contractor and the Installer shall handle the shock pad with caution to ensure it is not damaged in any way. Precautions shall also be taken to prevent damage to the sub-base during the installation of the material.
- B. Shock pad installed as a series of interlocking panels per the instructions provided by the manufacturer
- C. Shock pad shall be installed with geotextile side up.
- D. Detailed installation guidelines (e.g. installation manual) shall be requested by shock pad Installer and provided by shock pad manufacturer.
- E. Coordinate installation of foam pad with the synthetic turf installation as required to conform to both manufacturer warranties.

3.06 PERIMETER NAILER INSTALLATION

- A. Install recycled plastic perimeter nailer board in concrete band, wall and/or adjacent concrete paving, 5/8" below adjacent concrete finished surface. Secure in place with 3/8" galvanized steel expansion bolts spaced 24" o.c.

3.07 TURF INSTALLATION

- A. Install synthetic turf system in accordance with the manufacturer's written installation instructions.
- B. Turf shall be attached to the perimeter edge as shown in the construction plans and as per the manufacturer.

- C. All seams shall be brushed thoroughly before infill materials are installed.
- D. All terminations shall be as detailed and approved in the shop drawings.

3.08 INFILL INSTALLATION

- A. The synthetic turf shall be thoroughly brushed prior to installation of infill materials to remove wrinkles.
- B. Turf shall remain free draining at all times before, during and after the infill materials are installed.
- C. Broadcast infill uniformly over the synthetic turf at a rate as recommended by the manufacturer, at a rate of four (4) pounds per square foot, minimum.
- D. Comb to set infill.

3.09 CLEANING AND COMPLETION

- A. Protect all installed work from other construction activities as installation progresses.
- B. The Contractor shall keep the area clean throughout the construction period and free from the installation process, including track surfaces.
- C. Upon completion of the installation, thoroughly clean surfaces and site of all refuse resulting from the installation process, including adjacent surfaces.
- D. Any damage to existing fixtures or facilities resulting from the installation of the synthetic turf system shall be repaired to original condition at the Contractor's expense prior to Substantial Completion and commencement of the Warranty Period.
- E. A punch list will be written by the Owner's Representative at the conclusion of the project. Installation project deficiencies must be remedied by the Contractor prior to the issuance of a certificate of Substantial Completion.
- F. Contractor to provide a written acceptance by the Turf Manufacturer that the turf and base system is installed in accordance with their recommendations and as necessary for warranty prior to final completion.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. Fence framework, fabric, and accesso
2. Excavation for post bases; concrete foundation for posts.
3. Manual gates and related hardware.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 08 71 00 Door Hardware.
3. Section 32 16 00 Site Concrete.

1.02 REFERENCES

- A. ANSI/ASTM A123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
- B. ANSI/ASTM F567 – Installation of Chain link Fence.
- C. ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM C94 – Ready-mixed Concrete.
- E. Chain link Fence Manufacturers’ Institute (CLFMI) – Product Manual.

1.03 SYSTEM DESCRIPTION

- A. Fence Height: as noted on Drawings.
- B. Line Post Spacing: At intervals not exceeding 8 feet unless specified otherwise on Drawings.

1.03 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 33 00.
- B. Submit samples of Vinyl Slats for color selection by Engineer.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Installer: Company specializing in installations of chain-link fencing with a minimum of five years of experience. If any welding is required provide welders' certificates, verifying AWS qualification within the previous 12 months.

1.05 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on shop drawings.

1.06 WARRANTY

- A. Manufacture of slats to provide a 25 year warranty against color fading and breakage of slats.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Fabric:
 - 1. Tennis court - Non-Slatted Fabric: Black vinyl coated, standard Industrial grade, 1-3/4 inch mesh, 9 gauge hot-dipped galvanized steel wire, top selvage, knuckle end closed, bottom selvage, knuckled end closed.
 - 2. Non slatted 8' and 30' where noted on Drawings - Non-Slatted Fabric: Black vinyl coated tight weave: 2" mesh, 9-gauge zinc coated steel wire coated with black vinyl, top selvage knuckled tight, bottom selvage knuckled end closed. Posts to be powder coated where vinyl coated fabric occurs. Finish: ASTM F 668 Class 2b, 7mil (0.18 mm) thickness thermally fused over zinc-coated wire.
 - 3. Slatted 6', 8' and 16' fencing where noted on Drawings - Privacy Slatted Fabric: Black vinyl coated, industrial grade. 3-1/2-inch x 5" diamond mesh interwoven wire with factory installed 2.310" wide PDS "IDS" slats full height or approved equal. Secure slats with monel-clinch-lock staples. 9-gauge zinc coated steel wire, top selvage knuckled tight, bottom selvage knuckled end closed. Color as selected by Owner from Manufacturer's Standard range of colors. Slats to be fabricated of extruded high-density virgin polyethylene, containing color pigmentation and U.V. inhibitors.
- B. Line Posts: ASTM F1083 SCH 40 galvanized, unless noted otherwise on Drawings, size per Drawings.
- C. Terminal and Corner Posts: ASTM F1083 SCH 40 galvanized, unless noted otherwise on Drawings, size per Drawings.
- D. Gate Posts: ASTM F1083 SCH 40 galvanized, round, unless noted otherwise on Drawings, size per Drawings.

- E. Gate Frame: 1-7/8 inch SCH 40 galvanized diameter, for fittings and truss rod fabrication, unless noted otherwise on Drawings.
- F. Top Rail, Middle Brace Rail and Bottom Rail: ASTM F1083 SCH 40 galvanized, round, 1.66 inch diameter, plain end, sleeve coupled at top, unless noted otherwise on Drawings.
- G. Tie Wires: 9 gauge galvanized steel wire.
- H. Concrete: ASTM C94; Portland Cement, 2,500 p.s.i. strength at 28 days, 3-inch slump; one inch maximum sized coarse aggregate.
- I. Kickplate: 12 ga. Steel hot dipped galvanized.
- J. Cane Bolt Receiver: 1-1/4" x 8" galvanized pipe.

2.02 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel galvanized.
- C. Gate Hardware: Fork latch with gravity drop mechanical keepers; three 180 degrees gate hinges per leaf and hardware for padlock. Padlock to be provided by District.
- D. Accessible Gate Latch, Lockable; Paddle type lever that opens gate without full rotation.
- E. Baseball/Softball Fence Cap: Aer-Flo, Inc., PlasticCap, color to be yellow. Available through Aer-Flo, Inc., Bradenton, FL, (800) 823-7356, www.aerflowports.com.
- F. Tennis Court Wind Screen:
 - 1. Wind Screen shall be Collins Company Premier Series Polypropylene, or equal, with 78% wind and light blockage with open mesh, constructed of woven polypropylene and treated with UV stabilizers in a leno stitch pattern, with sewn reinforced border and binding with grommets. Screen shall be nine (9) feet high and length as required. Average life span shall be a minimum of five (5) years. Color to be dark blue. Contact Collins Company at www.collinscompany.com or (800) 222-4348, 5470 Daniels Street, Chino, CA 91710.
 - 2. Ty-Wraps made of heavy-duty plastic, self-locking, rated at 120 lb. breaking strength, 8" or 14" lengths, manufactured for attaching fence screens.

2.03 FINISHES

- A. Components and Fabric: Galvanized to ANSI/ASTM A123; 1.2 oz./sq. ft.
- B. Hardware: Galvanized to ASTM A153, 1.2 oz./sq. ft. coating.
- C. Accessories: Same finish as framing.
- D. All chain link fence components to have black vinyl coated finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ANSI/ASTM F567-93 and manufacturer's instructions.
- B. Drill caissons to diameter and depth as shown in the drawings, and or details. Clean holes and remove all loose dirt to a hard undisturbed bottom.
 - 1. When placing fence posts in existing asphalt, the existing asphalt shall be cored drilled with a diamond core hole saw 3' larger than the caisson diameter. Under no circumstances shall an auger dirt bit be used to drill through the asphalt.
 - 2. When placing fence posts where the new surrounding finish surface will be asphalt, the fence posts shall be placed first before the asphalt is laid. Top of post caisson shall be at the top of aggregate base.
- C. Set intermediate, terminal and gate posts plumb in concrete caisson. Slope top of concrete for water runoff. Use concrete vibrator in each caisson during concrete placement to settle and seat concrete.
- D. Line, Terminal, and Gate Post Footing Depth Below Finish Grade as noted on Drawings.
- E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail, on bay from end and gate post.
- F. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
- G. Install center and bottom rails all around enclosure.
- H. Stretch fabric between terminal posts.
- I. Position bottom of fabric 1 inch above finished grade unless noted otherwise on Drawings.
- J. Fasten fabric to top, center and bottom rail and line posts with tie wire at maximum 12 inches on centers.
- K. Attach fabric to end, corner and gate posts with tension bars and tension bar clips at 12 inches on center.
- L. Install gate with fabric to match fence. Install three hinges per leaf, Install latches, catches, retainers and locking clamp.
- M. Provide kickplate at all accessible gate accesses. Weld to gate frame with 3/16" x 1" welds at 4" o.c. Weld all 4 corners. Grind all welds and edges smooth. Treat all welds with galvanizing zinc "Hot Stick."

- N. All field welding to be performed by certified welder and all welds are to be ground down smooth and treated.
- O. All areas of welds are to be thoroughly cleaned, fluxed, and treated with galvanizing zinc "Hot Stick". Do not over heat pipe when treating.
- P. At double swing gates, install cane bolt receiver in concrete measuring 8" diameter, 12" deep.

3.02 ERECTION TOLERANCES

- A. Maximum variation from plum: 1/8 inch.
- B. Maximum offset from true position: 3/8 inch.
- C. Components shall not infringe adjacent property lines.

3.03 BASEBALL/SOFTBALL FENCE CAP: Install where shown on drawing plan and per manufacturer recommendations.

3.04 WIND SCREEN: Install wind screen per manufacturer recommendations using ty-wraps manufactured for this particular use. Install wind screen fabric flush to chain link fencing, perpendicular and parallel to fence framework, with no sagging and no wrinkles and secure in place using ty-wraps at each grommet location. Trim excess ty-wrap straps for a neat and uniform appearance.

END OF SECTION

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SECTION 32 80 00

IRRIGATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Construction Documents and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

A. DESCRIPTION

1. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the installation of an automatic sprinkler irrigation system, including all piping, sprinkler heads, controls, connections, testing, etc. as shown on the Drawings and as specified herein. The water source for this project is potable water [non-potable water].
2. Utilize and accept as standards manufacturer's recommendations and/or installation details for any information not specifically detailed on the Drawings.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
3. Division 26 – Electrical.
4. Section 31 00 00 – Earthwork.
5. Section 32 16 00 - Site Concrete.
6. Section 32 90 00 – Landscaping.

1.3 SUBMITTALS

- A. Comply with requirements of Section 01 33 00 – Submittals.
- B. Product names are used as standards; provide proof as to equality of any proposed material and do not use other materials or methods unless approved in writing by the Owner's Representative. Submit no more than one request for substitution for each item. The decision of the Owner's Representative is final.
- C. Use equipment capacities specified herein as the minimum acceptable standards.
- D. List materials in the order in which they appear in Specifications; include substitutions. Submit the list for approval by the Owner's Representative.

- E. Make any mechanical, electrical, or other changes required for installation of any approved, substituted equipment to satisfaction of Owner's Representative and without additional cost to Owner. Approval by Owner's Representative of substituted equipment and/or dimensional drawing does not waive these requirements.
- F. Do not construe approval of material as authorization for any deviations from Specifications unless attention of Owner's Representative has been directed to specified deviations.
- G. Record Drawings: Upon completion of work, and as a precedent to final payment, deliver to Owner's Representative one complete set of reproducible originals of Drawings showing work exactly as installed.
 - 1. Regularly update plans of the system and any changes made to the system throughout the project. Record all changes on this plan before trenches are backfilled.
 - 2. Record the as-built information on reproducible plans provided by the Architect. Complete and submit the Record Drawings to the Architect before applying for payment for work installed.
 - 3. As-built drawings are to be completed electronically with a pdf editing software or computer aided drafting software. As-built drawing done by hand will not be accepted for final submittal.
 - 4. Show the following on the Record Drawings accurately to scale and dimensioned from two permanent points of reference:
 - a. Distance of mainline from nearby hardscape.
 - b. Location of automatic control valves, quick couplers, and gate valves.
 - c. Location and size of all sleeves.
 - d. Location of automatic control wires and spares.
- H. Operation Manuals: Deliver two complete sets of manufacturer's warranties, Contractor guarantees, instruction sheets, parts lists and operation manuals to the Architect before requesting final acceptance of the project. Do not request final inspection until the sets are approved.

1.4 QUALITY ASSURANCE

- A. Qualifications of Contractor: Work must be completed by a licensed Landscape Contractor. Provide proof of five years of continuous experience in landscaping and irrigation of projects of similar size (+/- 20% of the construction cost) and scope for education campuses. Contractor to have a minimum of two projects either completed or in construction in the last five years.
- B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.
- C. Reviews: Specifically request reviews of all items listed below in "Inspection Requirements" prior to progressing to the next level of work.
- D. Certification: Ensure that the contractor installing the Central Control System is trained and certified in the installation of the Central Control System. The training and certification must have been completed within two years prior to the installation date.

E. Standards:

1. Provide work and material in full accordance with the rules and regulations of the California Electric Code; the California Plumbing Code; and other applicable state or local laws or regulations.
2. Furnish, without extra charge, additional material and labor required to comply with these rules and regulations, though the work may not be specifically indicated in the Specifications or Drawings.
3. Where the Specification requirements exceed those of the above-mentioned codes and regulations, comply with the requirements in the Specifications.

F. Comply with the requirements of Section 01 77 00 – Closeout Procedures.

G. Inspection Requirements

1. Request and hold a pre-construction meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner's Representative, and the Landscape Architect.
2. Prior to commencement of the work of this Section, obtain written verification from the project Civil Engineer that the rough grade in landscape areas is in conformance with Section 31 00 00 - Earthwork.
3. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:
 - a. Pressure testing of all mainlines and lateral lines (See "Hydrostatic Tests – Open Trench" in Part 3.05 of this Section),
 - b. Trench depth,
 - c. Sleeves under pavement,
 - d. Flushing of all mainlines and lateral lines,
 - e. Installation of mainline thrust blocks,
 - f. Installation of Leemco joint restraints and bolts,
 - g. Backfill and pipe bedding,
 - h. Layout of heads,
 - i. Operation of system and coverage adjustments (with Landscape Architect) after system is fully automated and operational, backfill of trenching is completed, and surface has been restored to original grades.
4. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect related work and material.
- B. Handle plastic pipe carefully, especially protecting it from prolonged exposure to sunlight. Store pipe on beds that are the full length of the pipe, and keep pipe flat and off the ground with blocks.

1.6 PROJECT/SITE CONDITIONS

- A. Information on Drawings relative to existing conditions is approximate. During progress of construction, make deviations necessary to conform to actual conditions, as approved by Owner's Representative, without additional cost to Owner. Accept responsibility for any damage caused to existing services. Promptly notify Owner's Representative if services are found which are not shown on Drawings.
- B. Protect existing utilities within construction area. Repair damages to utility lines that occur as a result of operations of this work.
- C. Verify dimensions at building site and check existing conditions before beginning work. Make changes necessary to install work in harmony with other crafts after receiving approval by Owner's Representative.

1.7 WARRANTY

- A. Guarantee all workmanship and materials hereunder against defective workmanship and materials, including damage by leaks and settlement of irrigation trenches, for the duration specified in Division 01 of these Specifications. (The Contractor is not responsible for vandalism or theft after date of final acceptance.)

1.8 SYSTEM STARTUP

- A. Booster Pump:
 - 1. Order booster pump as soon as possible to avoid delays in the project.
 - 2. After booster pump and electrical connections have been installed, power has been made available, the downstream irrigation system has been pressure-tested, heads have been set, and trenches have been backfilled and compacted, request that the booster pump manufacturer's technician participate in and/or direct the start-up of the booster pump. Start-up shall include all testing and settings for the following:
 - a. Flow
 - b. Pressure
 - c. Connections
 - d. Electrical currents
 - e. Wire connections
 - f. Pump installation
 - 3. Upon successful completion of testing by the booster pump technician, request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.
- B. Central Control System

1. Install controllers, master valves, flow sensors, ground system, wiring, cables, Ethernet and any other components not shown on the Drawings.
2. Request that the manufacturer's representative participate and/or direct the start-up of the Central Control System. Start-up shall include all testing and settings for the following:
 - a. Flow sensor
 - b. Grounding
 - c. Wire connections
 - d. Pump start
 - e. Bypass
 - f. Overall instruction
3. Upon successful completion of testing by the technician from [enter technician company], request that a checklist/certification be completed and signed by the technician. Deliver copies of the certification to both the Owner's Representative and the Landscape Architect prior to the commencement of the landscape maintenance period.
4. Run the system; record the flows per valve and report them to the Owner's Representative.

1.9 MAINTENANCE

- A. Furnish three complete sets of operating maintenance instructions bound in a hardback binder and indexed. Start compiling data upon approval of list of materials. Do not request final inspection until booklets are approved by Owner's Representative.
- B. Incorporate the following information in these sets:
 1. Complete operating instructions for each item of irrigation equipment.
 2. Typewritten maintenance instructions for each item of irrigation equipment.
 3. Manufacturer's bulletins which explain installation, service, replacement parts, and maintenance.
 4. Service telephone numbers and/or addresses posted in an appropriate place as designated by Owner's Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials as specified; any deviation from the Specifications must first be approved by the Owner's Representative in writing. All material containers or certificates shall be clearly marked by manufacturer as to contents for inspection.
- B. Automatic Controller: Refer to Drawings.
- C. Master Valves and Flow Sensors: Refer to Drawings.
- D. Automatic Control Valves: Refer to Drawings.
- E. Drop Control Kit: Refer to Drawings.

F. Gate Valve: Refer to Drawings.

G. Pipe and Fittings:

1. PVC pipe laterals: PVC schedule 40.
2. PVC pipe mainlines: PVC schedule 40 up to 3" in size and PVC Class 200 for 4" to 6" and larger.
3. PVC fittings three-inch (3") size and smaller: High impact, standard weight, Schedule 40, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal. [LEEMCO APPLICATION - PVC fittings for mainline two inches (2") and smaller and all lateral lines: High impact, standard weight, Schedule 40, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal.]
4. PVC fittings four-inch (4") size and larger: High impact, standard weight, Class 200 gasketed, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal. [LEEMCO APPLICATION - Ductile iron fittings for all mainline fittings two and one-half inches (2 ½") and larger: Leemco joint restraint fittings or approved equal.]
5. All plastic pipe and fittings: Continuously and permanently marked with manufacturer's name, type of material, IPS size, schedule, NSF approval, and code number.
6. Threaded PVC pipe and nipples: IPS Schedule 80 when necessary to use threaded connections to gauges, valves, or control valves. Threaded adapters may be used in place of nipples when making pipe to valve connections.
7. Use 45-degree fittings for changes in depth of pipe, and at transition from main line to automatic control valves.
8. Piping above ground: Schedule 40 galvanized steel with cast-iron fittings.
9. Piping used for electrical purposes to be Schedule 40 PVC Rigid Nonmetallic Conduit electrical conduit.

H. Booster Pump: Refer to Drawings.

I. PVC Primer: Weld-On P-70 Purple Primer or approved equal.

J. PVC Glue: Weld-On 711 Gray heavy bodied PVC Cement or approved equal.

K. Sprinkler Heads: Refer to Drawings.

L. Quick Coupler Valves: Rainbird 44np or approved equal.

M. Plastic Valve Boxes and Covers:

1. Plastic valve boxes shall be green in color.
2. Shall have locking or bolt down type lids.
3. Markings on valve box covers shall be "heat branded" onto the cover in 1-inch high letters.
4. Manufacturer Carson Industries, Applied Engineering, Inc., NDS, Christy or equal.
5. Valves box dimensions shall be as follows:

- a. Master Valve, Rectangular
Valves 1 inch and 1-1/2 inches: Carson 1419-12 with 1419-T locking lid or equal.
Valves 2 inches and larger: Carson 1730-24 with 1730T locking lid or equal.
Boxes shall be labeled as "Irrigation - MV" on lid.
- b. Flow Sensor, Rectangular
Sensors up to 4 inches: Carson 1419-12 with 1419-T locking lid or equal.
Boxes shall be labeled as "Irrigation - FS" on lid.
- c. Ball Valves, Round
Carson 910-10 with 910-T locking lid or equal.
Boxes shall be labeled as "Irrigation - BV" on lid.
- d. Gate Valves, Round
Carson 910-10 with 910-T locking lid or equal.
Boxes shall be labeled as "Irrigation - GV" on lid.
- e. Remote Control Valves, Rectangular
Valves 1 inch and 1-1/2 inches: Carson 1419-12 with 1419-T locking lid or equal.
Valves 2 inches and larger: Carson 1730-12 with 1730-T locking lid or equal.
Boxes shall be labeled as "Irrigation - RCV" on lid.
- f. Quick Coupling Valves, Round
Carson 910-10 with 910-T locking lid or equal.
Boxes shall be labeled as "Irrigation - QC" on lid.

N. Reduced Pressure Backflow Preventer: Refer to Drawings.

O. Automatic Sprinkler Control Wire:

- 1. Connections between remote control valves and controller: 14 AWG direct burial plastic polyethylene (PE) insulated wire, Paige Electric P7079D or approved equal. Common wire to be white, and lead wire to be colored. If multiple controllers are used, a different color is to be used for each controller's lead wire. (Use red for the first controller). Spare wires are to be yellow.
- 2. UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
- 3. Provide adequate working space around electrical equipment in compliance with local codes and ordinances.
- 4. Electrical, other than low voltage, such as power wiring, conduit, fuses, thermal overloads and disconnect switches, is included under Division 26 of these Specifications.

P. Automatic Sprinkler Control Decoder Cable [For expansion of existing two-wire systems only]:

- 1. Connections between remote control valve decoders and controller: Hunter Jacketed Decoder

Cable, Paige Electric P7354D. If multiple controllers are used, a different color jacket is to be used for each controller.

2. UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
 3. Provide adequate working space around electrical equipment in compliance with local codes and ordinances.
 4. Electrical, other than low voltage, such as power wiring, conduit, fuses, thermal overloads and disconnect switches, is included under Division 26 of these Specifications.
- Q. Single Station Decoder: match existing two-wire system decoder.
- R. Trace Wire:
1. Direct burial #12 AWG Solid, steel core soft drawn tracer wire, 250# average tensile break load, 30 mil high molecular-high density polyethylene jacket complying with ASTM-D-1248, 30-volt rating. Color shall be green.
 2. Connectors: UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
- S. Master Valve and Flow Sensor Wire:
1. Master valve wires are to be 14 AWG direct burial plastic polyethylene (PE) insulated wire, Paige Electric P7079D or approved equal. Wire color to be blue for the lead and white for the common. If there are two master valves, the second master valve wire is to be blue/white striped for the lead and white for the common.
 2. Flow sensor wires are to be 14 AWG direct burial plastic polyethylene (PE) insulated wire, Paige Electric P7079D or approved equal. Wire color to be black for the lead and white for the common. If there are two flow sensors, the wires leading to each flow sensor is to be a different color.
- T. Unions And Flanges:
1. Steel unions and flanges two inches (2") and smaller: 150 lb. screwed black (brass to iron seat) or galvanized malleable iron (ground joint).
 2. Steel unions and flanges two and one-half inches (2 ½") and larger: 150 lb. black flange union, flat-faced, full gasket.
 3. Gaskets: One-sixteenth inch (1/16") thick rubber Garlock No. 122, Johns-Manville or approved equal.
 4. Flange Bolts: Open-hearth bolt steel, square heads with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper-plated steel bolts and nuts or brass bolts and nuts for brass flanges.
- U. Pipe Supports: Adjustable saddle support type support.
- V. Valve Identification Tags: Christy's irrigation ID tags, standard yellow color or approved equal.
- W. Sand for Trench Backfill: Natural sand, free of roots, bark, sticks, rags, or other extraneous material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Locations of existing utilities and other improvements shown on the Drawings are approximate. Verify existing conditions and, should any utilities be encountered that are not indicated on the plans, notify the Owner's Representative immediately. Accept responsibility for any damages caused to existing services.

3.2 PREPARATION

- A. Scheduling: Notify the Project Inspector prior to commencing and/or continuing the work of this Section. Remove and replace, at no cost to Owner, any work required as a result of failure to give the appropriate notification.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Measurements: Take field measurements; report variance between plan and field dimensions.
- D. Protection: Maintain warning signs, shoring and barricades as required. Prevent injury to, or defacement of, existing improvements. At no additional cost to Owner, repair or replace items damaged by installation operations.
- E. Existing Tree Protection:
 - 1. Avoid unnecessary root disturbance, compaction of soils within drip line, or limb breakage.
 - 2. Do not store material or dispose of any material other than clean water within the drip line.
 - 3. Provide adequate irrigation during construction.
 - 4. Replace any tree damaged during construction with a tree of equal size and value at no additional cost to Owner.
 - 5. Adjust trench locations in field to minimize damage to existing elements and plant roots of trees-to-remain at no additional cost to Owner.
- F. Surface Preparation: Prior to beginning sprinkler irrigation work, complete placement of topsoil as specified in Section 31 00 00 – Earthwork. Notify Project Inspector of irregularities if any.

3.3 INSTALLATION

A. Automatic Controller

- 1. Automatic Controller: Install system and components as per Drawings and manufacturer's recommendations. All wiring connections shall be neatly accomplished within the controller cabinet. Connect Ethernet and grounding system as per manufacturer's recommendations.
- 2. Connect automatic control valves to controller(s) in sequence as shown on Drawings.
- 3. Install all exposed wires to a minimum of twenty-four inches (24") beyond controller within a UL approved rigid conduit.

B. Master Valves and Flow Sensor

1. Master Valve: Install as per manufacturer's recommendation. Connect master valve wiring to the automatic controller. Install wire in a conduit. Wire is not to have any splices between the valve and the controller.
 2. Connect Master Valve to decoder cable using a single-station line decoder.
 3. Flow Sensor: Install as per manufacturer's recommendation. When using a "saddle" installation, install at the correct depth in the pipe and orientate the paddle properly for accurate reading of flow. Connect flow sensor wire to the automatic controller. Install wire in a conduit. The wire is not to have any splices between the valve and the controller.
 4. Connect Flow Sensor to decoder cable using a sensor decoder.
- C. Reduced-Pressure Backflow-Prevention Device
1. Install where shown, per code, and per manufacturer's specification and written instructions.
 2. Provide pipe supports and accessories as necessary to properly secure the assembly.
- D. Booster Pump Assembly
1. Booster Pump: Install as per manufacturer's directions and as detailed on Drawings. Lay out piping in field for exact locations and/or connections.
 2. Booster Pump Pad: Install on a level, raised utility pad so booster pump is set level. Encase anchor bolts in the concrete pad.
 3. Piping Assembly: Lay out system plumb and level. Paint entire assembly, including the pipe supports. Use metal pipe for all exposed pipe and extend below the ground to the horizontal main line pipe.
 4. Coordination: Lay out conduit for electrical components to minimize conduit above grade.
- E. Control Wires
1. General: Install control wires beneath sprinkler main line whenever possible; tape wires to mainline pipe. Provide one spare wire for each controller.
 2. Slack Wire: Provide eighteen inches (18") of slack wire for each wire connected to automatic control valve. Slack wire shall be coiled and left in the valve box. Tape wires in bundles every ten feet (10'); do not tape wires in sleeves.
 3. Expansion and Contraction: Snake wire in trench to allow for contraction of wire.
 4. Wire Passing Under Existing or Future Paving or Construction: Encase in PVC Schedule 40 or galvanized steel conduit extending at least twelve inches (12") beyond edges of paving or construction.
 5. Wire Connections: Install wire connections in a waterproof sealing pack.
 6. Wire Splicing: Permit splicing only on runs exceeding 500 feet. Locate all splices within valve boxes.
 7. Wire Termination: Install wire in a valve box with eighteen inches (18") of slack wire coiled and individually capped with approved waterproof sealing pack.
 8. Spare Wire: Install two (2) spare wires along each wire path. If there is more than one wire path from the controller, the contractor to install two (2) spare wires per path. Provide eighteen inches (18") of slack wire at each automatic control valve.

F. Decoder Cable

1. General: Install control wires beneath sprinkler main line whenever possible.
2. Slack Cable: Provide eighteen inches (18") of slack cable at each automatic control valve. Slack cable shall be coiled and left in the valve box.
3. Expansion and Contraction: Snake cable in trench to allow for contraction of cable.
4. Cable Passing Under Existing or Future Paving or Construction: Encase in PVC Schedule 40 or galvanized steel conduit extending at least twelve inches (12") beyond edges of paving or construction.
5. Connections: Install cable connections in a waterproof sealing pack.
6. Splicing: Permit splicing only on runs exceeding 500 feet. Locate all splices within valve boxes.
7. Cable Termination: Install cable in a valve box with eighteen inches (18") of slack cable coiled and individually capped with approved waterproof sealing pack. Ground cable at all cable terminations.

G. Trace Wire

1. General: Install trace wire above sprinkler main line whenever possible; tape wire to mainline pipe at 10' intervals to ensure the wire remains adjacent to the pipe.
2. Wire Connections: Install wire connections in a waterproof sealing pack.
3. Trace wire access points shall be accessible at all automatic control valves.
4. At all mainline end caps, a minimum of six feet (6') of tracer wire shall be coiled and secured to the cap for future connections. The end of the tracer wire shall be spliced to the wire of a six-pound zinc anode and is to be buried at the same elevation as the irrigation mainline.
5. Testing: The contractor shall perform a continuity test on all trace wires in the presence of the client. If the trace wire is found to be not continuous after testing, Contractor shall repair or replace the failed segment of the wire.

H. Automatic Control Valves and Quick Coupler Valves

1. Install where shown and where practical; place no closer than twelve inches (12") to walk edges, building walls, or fences. Refer to detail for example.
2. Thoroughly flush mainline before installing valve.
3. Install valves in ground cover areas where possible.

I. Piping

1. General: Install in conformance with reference standards, manufacturer's written directions, as shown on Drawings and as herein specified.
2. Workmanship:
 - a. General: Install sprinkler irrigation equipment in planted areas throughout the site.
 - b. Coordination: Organize location of sleeves with other trades as required.
3. Pipeline Assembly:
 - a. General:
 - 1) Cutting: Cut pipe square; remove rough edges or burrs.
 - 2) Solvent-welded Connections: Use materials and methods recommended by the pipe manufacturer.

- 3) Brushes: Use non-synthetic brushes to apply solvents and primer.
 - 4) Cleaning: Clean pipe and fittings of dirt, moisture, and debris prior to applying solvent or primer.
 - 5) Assembly: Allow pipe to be assembled and welded on the surface or in the trench.
 - 6) Expansion and Contraction: Snake pipe from side to side of trench to allow for expansion and contraction.
 - 7) Location: Locate pipes as shown on Drawings except where existing supply valves, utilities or obstructions prohibit or where slight changes are approved to better suit field conditions.
- b. Elastomeric Seal (Gasket) Joints:
- 1) General: Assemble in strict conformance with the pipe manufacturer's instruction.
 - 2) Rubber Rings: Use rubber rings specific for water service systems.
 - 3) Cleaning: Thoroughly clean ring and groove of dirt, moisture and debris using a clean, dry cloth. Do not use solvents, lubricants, cleaning fluids or other material for cleaning.
 - 4) Seating: Properly seat ring in groove.
 - 5) Spigot: Clean spigot-end of pipe as in "Cleaning" above prior to applying lubricant recommended by pipe manufacturer. Insert spigot into bell and seat to full depth required.
- c. Connections:
- 1) Threaded Plastic Pipe Connection:
 - a) Use Teflon tape or pipe joint compound.
 - b) When assembling to threaded pipe, take up joint no more than one full turn beyond hand-tight
 - 2) Metal Valves and Plastic Pipe: Use threaded plastic male adapters.
 - 3) Metal to Metal Connections:
 - a) Use specific joint compound or gasket material for type of joint made. Where pipe of dissimilar metals are connected, use dielectric fittings.
 - b) Where assembling, do not allow more than three full threads to show when joint is made up.
 - 4) Where assembling soft metal (brass or copper) or plastic pipe, use strap-type friction wrench only; do not use a metal-jawed wrench.
 - 5) Threading:
 - a) Do not permit the use of field-threading of plastic pipe or fittings. Use only factory-formed threads.
 - b) Use factory-made nipples wherever possible. Permit the use of field-cut threads in metallic pipe only where absolutely necessary. When field-threading, cut threads accurately on axis with sharp dies.
 - c) Use pipe joint compound for all threaded joints. Apply compound to male thread only.
- d. Sleeves and conduits:
- 1) Use sleeves of adequate size to accommodate retrieval for repair of wiring or piping and extend a minimum of twelve inches (12") beyond edges of walls or paving.
 - 2) Provide removable, non-decaying plug at end of sleeve to prevent entrance of soil.

- e. Unions: Locate unions for easy removal of equipment or valve.
- f. Joint Restraints: Install per manufacturer's recommendations.
- g. Capping: Plug or seal opening as lines are installed to prevent entrance materials that would obstruct pipe. Leave in place until removal is necessary for completion of installation.
- h. Drip Irrigation Tubing: Install as per Drawings.

J. Sprinkler Heads

- 1. Sprinkler heads: Locate as shown on the Drawings except where existing conditions prohibit, or slight changes are approved to achieve as good or better coverage under the same conditions. Do not allow sprinkler head spacing to exceed the maximum shown on the Drawings. Plumb heads.
- 2. Handling, Assembly of Pipe, Fittings, and Accessories: Allow only skilled tradesmen to handle and assemble pipe, fittings and equipment. Keep interior of pipes, fittings and accessories clean at all times. Close ends of pipe immediately after installation; leave closure in place until removal is necessary for completion of installation. Do not permit bending of pipe.
- 3. Flushing: Remove end heads and operate system at full pressure until all rust, scale, and sand is removed. Divert water to prevent ponding or damage to finished work.
- 4. Coverage: Accept responsibility for full and complete coverage of irrigated areas to satisfaction of Landscape Architect and make necessary adjustments to better suit field conditions at no additional costs to Owner.

3.4 CONSTRUCTION

A. Grading

- 1. Install all irrigation features to their finished grade and at depths indicated. Complete and /or accommodate all rough grading and/or finish grading before commencing with trenching.

B. Layout

- 1. Lay out work as accurately as possible to Drawings. Drawings are generally diagrammatic to extent that swing joint offsets and fittings are not shown. Record all changes on the Record Drawings.
- 2. Do not willfully install the irrigation system as shown on Drawings when it is obvious, in the field, that obstructions or other discrepancies exist which may not have been considered in the design. Notify Owner's Representative of discrepancies before proceeding.

C. Excavating And Trenching

- 1. General: Perform excavations as required for installation of work included under this Section, including shoring of earth banks to prevent cave-ins. Restore surfaces, existing underground installations, etc., damaged or cut as result of this work to their original condition and in a manner approved by the Landscape Architect.
- 2. Width:

- a. Make trenches wide enough to allow a minimum of six inches (6") between parallel pipelines and three inches (3") between side of pipe and side of trench. Do not allow stacking of pipe within trench.
 - b. Allow a minimum clearance of twelve inches (12") in any direction from parallel pipes of other trades.
3. Preparation of Excavations: Remove rubbish and rocks from trenches. Bed pipe on a minimum of three inches (3") of clean, rock-free soil to provide a firm, uniform bearing for entire length of pipeline. Cover pipe with a minimum of three inches (3") of clean, rock-free soil. If clean, rock-free soil is not available, use sand for pipe bedding and three inches (3") of backfill above the pipe. The remainder of the trench backfill material can be native soil. Do not allow wedging or blocking of pipe.
 4. Minimum depth of cover: Unless shown otherwise, provide the following minimums:
 - a. Mainline: twenty-four inches (24") cover.
 - b. Lateral line: twelve inches (12") cover for spray heads, and eighteen inches (18") cover for rotor heads.
 5. Conflicts with other trades:
 - a. Hand-excavate trenches where potential conflict with other underground utilities exist.
 - b. Where other utilities interfere with irrigation trenching and piping work, adjust the trench depth as instructed by Owner's Representative.

D. Thrust Blocks

1. To resist system pressure on ring-tite PVC pipe and PVC fittings, provide thrust blocks at any change of direction, change of size, dead end, and/or valves at which thrust develops when closed. See thrust block details for examples.
2. Use cast-in-place concrete and size thrust blocks based on an average soil-safe bearing load of 700 lbs. per square foot.
3. Form thrust blocks in such a manner that concrete comes in contact only with the fittings. Place thrust block between adequately compacted soil and the fitting.
4. Thrust blocks are to be constructed of concrete with a minimum of 2500psi.
5. Thrust blocks are to be free, separate, and independent of adjacent or nearby thrust blocks.
6. Thrust blocks shall not be used on joints with LEEMCO joint restraints.

E. Backfill And Compacting

1. General: Do not begin until hydrostatic tests are completed. When system is operating and after required tests and inspections have been made, backfill trenches under paving areas to the compaction rate specified in Section 31 00 00 – Earthwork.
2. Place backfill in six-inch (6") layers and compact with an acceptable mechanical compactor.
 - a. Compact backfill material in landscape areas to eighty-five percent (85%) maximum dry density of the soil.
 - b. If settlement occurs along trenches, make adjustments in pipes, valves, and sprinkler heads, soil, sod or paving as necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, without additional cost to the Owner.

3. Excess Soil: Remove all rocks, debris, and excess soil that results from sprinkler irrigation trenching operations, landscape planting, and soil preparation operations off site at no additional cost to the Owner. If soil meets topsoil requirements in Section 31 00 00 – Earthwork, it may be used for finish grading.
4. Finishing: Dress-off areas to eliminate construction scars.

F. Flushing Lines

1. Thoroughly flush lines prior to installing valves, performing hydrostatic testing, or installing sprinklers. Divert water to prevent washouts.

G. Concrete Work

1. Underground anchors and pads for valves boxes are included under this Section of Specifications. Concrete shall have a minimum strength of 2500 psi. The slump test shall be a -

3.5 FIELD QUALITY CONTROL

- A. Visual Inspection: Verify that all pipe is homogenous throughout and free from visual cracks, holes, or foreign materials. Inspect each length of pipe. All materials are subject to impact test at the discretion of the Landscape Architect.
- B. Hydrostatic Tests – Open Trench:
1. Center-load piping with a small amount of backfill to prevent arching or slipping under pressure.
 2. Request the presence of the Project Inspector in writing at least forty-eight hours in advance of testing.
 3. At no additional cost to Owner, test in the presence of the Project Inspector.
 4. Apply continuous static water pressure of 100 psi when welded plastic joints have cured at least twenty-four hours, and with the risers capped, as follows: test main lines and submains for four hours; test lateral lines for two hours.
 5. Repair leaks resulting from tests; and repeat tests.
 6. Test to determine that all sprinkler heads function according to manufacturer's data and give full coverage according to intent of Drawings. Replace any sprinklers not functioning as specified with ones that do, or otherwise correct system to provide satisfactory performance.
- C. Continuity Testing: Test locating device and control wires for continuity prior to and after back-filling operations.

3.6 ADJUSTING

- A. Adjusting System: Prior to acceptance, satisfactorily adjust and regulate entire system. Set watering schedule on controller appropriate to types of plants and season of year. Adjust remote control valves to operate sprinkler heads at optimum performance based on pressure and simultaneous demands through supply lines.
- B. System Layout: Provide reduced prints of Record Document irrigation plans, laminated in four (4)

- mil. plastic, of size to fit controller door. Enlarge remote-control valve designations as necessary for legibility. Color-code areas covered by each station. Affix plans to inside of controller door.
- C. Instructions: Upon completion of work, instruct maintenance personnel on operation and maintenance procedures for entire system.
 - D. Flow Charts: Record and prepare an accurate flow-rate chart for each automatic control valve.

3.7 CLEANING

Remove debris resulting from work of this Section.

END OF SECTION

SECTION 32 90 00

LANDSCAPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the following work as specified herein:
2. Soil Preparation and Fertilization
3. Planting
4. Weed Control
5. Mulch
6. Clean-up
7. Landscape Maintenance Period
8. Guarantee
9. Work not included in this Section: Landscape elements such as concrete walks, fencing, outdoor lighting, rough grading, and clearing are not a part of this Section unless shown on the landscape Drawings.

B. Related Sections:

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 31 00 00 – Earthwork.
3. Section 32 80 00 – Irrigation.

1.03 SUBMITTALS

- A. See Section 01 33 00 – Submittals for additional requirements.
- B. Plant Material: Within fifteen (15) days after award of contract, locate plant materials required for construction. Ensure that trees and shrubs are contract- grown from a certified nursery. Notify Owner’s Representative of plant material “tied off” for review at selected nursery. If specified material is not obtainable, submit the following to Owner’s Representative: proof of non-availability, proposal for use of equivalent material, photographs of alternative choices of plant material. Include clear, written description of type, size, condition, and general character of plant material.
- C. Data Sheets: Provide product data for each type of landscape material indicated in the Drawings

and Specifications.

- D. Samples: Submit samples of the following materials to Landscape Architect for approval:
 - 1. Soil amendment: (3) one-quart zip-locked plastic bags.
 - 2. Bark Mulch: (3) one-quart zip-locked plastic bags.
 - 3. Imported Topsoil: (3) one-quart zip-locked plastic bags. (if needed)
- E. Provide soils analysis reports prepared by a qualified soils laboratory in compliance with the Soil Testing Requirements under "Soil Testing" in Part 3.02 of this Section.
- F. Prior to planting, submit copies of all trucking or packaging tags for all soil amendment, fertilizer and other additives to Landscape Architect so the quantities can be verified.
- G. Record Drawings: Upon completion of work, and as a precedent to final payment, deliver to Owner's Representative one complete set of reproducible originals of Drawings showing work exactly as installed.

1.04 QUALITY ASSURANCE

- A. Qualifications: Work must be completed by a licensed Landscape Contractor. Provide proof of five years of continuous experience in landscaping and irrigation of projects of similar size (+\ -20% of the construction cost) and scope for education campuses. Contractor to have a minimum of two projects either completed or in construction in the last five years.
- B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.
- C. Reviews: Specifically request reviews of all items listed below in "Inspection Requirements" prior to progressing to the next level of work. The Owner's Representative reserves the right to inspect and reject material, both at place of growth and at site, before and/or after planting, for compliance with requirements for name, variety, size and quality.
- D. Reference Standards: Meet or exceed Federal, State and County laws requiring inspection of all plants and planting materials for plant disease and insect control.
- E. Delivery, Storage, and Handling:
 - 1. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.
 - 2. Bulk Materials:
 - a. Do not dump or store bulk materials near structures, utilities, walkways or pavements, or on existing turf areas or plants.
 - b. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - c. Accompany each delivery of bulk fertilizers [,lime,] and soil amendments with

appropriate certificates.

F. Plant Material:

1. Conform to the current edition of Horticultural Standards for quality of Number 1 grade nursery stock as adopted by the American Association of Nurserymen. Conform to sizes specified on plant legend. Select plants which have a natural shape and appearance.
2. Select only plants that are true to name, and tag one of each bundle or lot with the name of the plant in accordance with the standards of practice of the American Association of Nurserymen. In all cases, botanical names shall take precedence over common names.
3. Tag each plant of a patented variety with the variety and identification number, where applicable, as it is delivered to the job site.
4. Select only plants which have been nursery-grown in accordance with good horticultural practices and which have been grown under climatic conditions similar to those in the locality of the project for at least one year.
5. Select only plants which are typical of their species or variety; have normal habits of growth; are sound, healthy, vigorous, well-branched and densely-foliated when in leaf; are free of disease, insect pests, eggs or larvae; and have a healthy and well-developed root system.
6. Select only container stock that has been grown in the containers in which delivered for at least six (6) months, but not over two (2) years. Provide samples to show that there are no root-bound conditions.
7. Do not use plants that are severely pruned or headed-back to meet size requirements.
8. Do not plant container-grown plants that have cracked or broken balls of earth when taken from the container. Remove canned stock carefully from cans after containers have been cut on two sides with tin snips or other approved cutter.
9. Coordinate a time for the Landscape Architect to inspect the plants upon their delivery to the project site.
10. At any time prior to final acceptance, be prepared to replace any plants that are rejected by the Owner's Representative because of physical damage to the plant.
11. Do not remove container-grown stock from containers before time of planting.
12. Be prepared to replace plants which are rejected by the Owner's Representative for the following reasons:
 - a. Trunk bark damage caused by sunburn,
 - b. Trunk bark wounds caused by rubbing stakes or ties,
 - c. Trunk bark damage caused by ties that have girdled the tree,
 - d. Tree head development that is lopsided and not symmetrical in form,
 - e. Tree branches that cross or touch,
 - f. Tree branches with double leaders (unless multi-trunk trees are specified).
13. Stake shrubs with one-inch by one-inch by eighteen-inch (1"x1"x18") stakes in such manner that the stakes are not visible, and tie to upright position if they lean and/or are not growing in a vertical position.
14. Furnish quantities necessary to complete the work as shown on the Drawings and, if necessary, make up for any discrepancies in the quantities given in the Plant List at no additional cost to Owner.

G. Comply with the requirements of Section 01 77 00 – Contact Closeout and Final Cleaning.

1.05 INSPECTION REQUIREMENTS

- A. Landscape Architect reserves the right to examine and reject plant material both at place of growth and at site, before and after planting, for compliance with requirements of name, variety, size, and quality.
- B. Request and hold a pre-construction meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner's Representative, and Landscape Architect.
- C. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:
 - 1. Rough grading is to tolerances specified in Section 31 00 00 – Earthwork.
 - 2. The placement of landscape backfill material is as specified in this Section.
 - 3. Prior to the commencement of the work specified in this Section, the coverage and operation of the sprinkler irrigation system are as specified in Section 32 80 00 - IRRIGATION.
 - 4. The soil amendment does not include any metal fragments. (Obtain a letter from the manufacturer stating that the material submitted for use on this project has no metal or foreign objects. Submit this letter as part of the Data Sheet submittal package [see "Submittals and Substitutions" in this Section])
 - 5. Required Test: For each load of soil amendment delivered to the site, spread at least two cubic yards (2 cy) of material onto a paved surface approximately two inches (2") deep. Pass a magnetic rake over the material in two directions. If any metal is found, test the entire load in the same manner. Perform all testing in the presence of the Project Inspector.
 - 6. Soil amendments, fertilizer, bark mulch and materials used for hydroseeding have been delivered to the site by the supplier, the invoices from the supplier indicate the project name and quantities delivered, and the Project Inspector has received copies of all such documents.
 - 7. Prior to planting, amendments and conditioners have been incorporated as per pre-planting recommendations, and planting areas have been made ready to receive planting.
- D. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.
- E. Beginning of Maintenance Period: Verify all work is complete, then request and hold a meeting to include the Landscape Architect, Project Inspector, Architect and Owner's Representative for authorization to begin the landscape maintenance period.
- F. End of Maintenance: Verify that all work is complete and acceptable, and that the maintenance has been completed per specifications; and continue to provide landscape maintenance until the Owner's Representative has accepted the work.

1.06 PROJECT/SITE CONDITIONS

- A. Provide protection for persons and property throughout progress of work. Use temporary barricades as required. Proceed with work in such manner as to minimize spread of dust and flying particles and to provide safe working conditions for personnel. Store materials and equipment where directed.
- B. Existing Construction: Execute work in an orderly and careful manner to protect paving, work of other trades, and other improvements.
- C. Existing Utilities: Provide protection for existing utilities within construction area. At no additional cost to Owner, repair any damages to utility lines that occur as a result of this work.
- D. Landscaping: Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods.
- E. Paving: Maintain cleanliness of paving areas and other public areas used by equipment, and immediately remove spillage; remove rubbish, debris, and other material resulting from landscaping work, leaving site in a safe and clean condition.
- F. Planting Schedule / Environmental Requirements
 - 1. Install, establish, and maintain all lawn areas for a minimum of ninety (90) days prior to date of substantial completion. Coordinate schedule with other work and overall project schedule. Failure to install lawn areas by this date shall result in assessment of liquidated damages.
 - 2. Proceed with work in an orderly and timely manner to complete installation of landscaping within contract limits.
 - 3. Planting Season Limits: Do not plant when grounds are wet or temperature is below 25° F. Do not proceed with any soil preparation and fertilization if all planting cannot be completed within Planting Season Limit.

1.07 WARRANTY

- A. The guarantee period for lawn and plant material shall be the duration of the landscape maintenance period, from commencement until final acceptance of the work of this Section. See Division 01 for other applicable guarantee requirements.
- B. During the guarantee period, repair and/or replace plants and lawn not in satisfactory growing condition, as determined by Owner's Representative, without additional cost to Owner. Plants are to be replaced as per "Landscape Maintenance" in Part 3.05 of this Section, using plants of the same kind and size specified in plant list.

1.08 MAINTENANCE

- A. Beginning of Landscape Maintenance Period:
 - 1. General: Landscape Maintenance Period does not begin until all work is installed and lawn has evenly germinated to an approximated blade height of one and one-half inches

spread until testing requirements have been satisfied.

- D. Fertilizer/Soil Conditioner: Gro-Power Plus or approved equal.
- E. Fertilizer for Trees and Shrubs: Seven-gram Gro-Power Planting Tablets (12-8-8 NPK) or approved equal.
- F. Vitamin B-1: "Superthrive", "Liquinox Start", "Cal-Liquid", or approved equal.
- G. Bark Mulch: Untreated, shredded cedar.
- H. Tree-staking System: As indicated on Drawings.
- I. Pre-Emergent Weed Control: Oxadiazon, "Treeflan", "Ronstar 2G", "Surflan" (Elano Products Company), or approved equal.
- J. Erosion Control Blankets: The erosion control/re-vegetation blanket shall be lightweight and comprised primarily of straw, excelsior, virgin wood fiber, jute or coconut fibers. It shall conform easily to the soil surface allowing vegetation to emerge unimpeded, contain no growth-inhibiting additives and shall be free of weed-seed and other contaminants. The blanket shall be designed to be left in place to degrade. Include manufacturer's recommended biodegradable staples, six inches (6") long.
- K. Jute Mesh: Shall be of a uniform, open, plain weave, flame-retardant mesh, made from unbleached single jute yarn. The shall be of loosely twisted construction and shall not vary in thickness by more than one-half its normal diameter. Jute mesh shall be furnished in rolled strips and shall meet the following requirements.
 - 1. Width: 48 inches, with a tolerance of +/- one inch.
 - 2. 78 warp ends per width, 41 weft ends per yard.
 - 3. Weight shall average 1.22 pounds per linear yard, with a tolerance of +/- 5%.
 - 4. Jute Mesh staples: 18" long, #10 steel wire.
- L. Weed Fabric: As indicated on Drawings.
- M. Header Boards: As indicated on Drawings.
- N. Root Barrier: As indicated on Drawings.
- O. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, three ounces per square yard (3 oz/sq. yd.) (101 g./sq. m.) minimum, composed of fibers formed into a stable network so that fibers retain their relative positions. Fabric shall be inert to biological degradation and resistant to naturally-encountered chemicals, alkalis, and acids.
- P. Nursery Plant Stock:
 - 1. As indicated on Drawings. Do not remove container-grown stock from containers until planting time. Plants shall be true to name.

2. Healthy, shapely, well-rooted, not pot-bound, free from insect pests or plant diseases and properly "hardened off" before planting. Replace plants that are not alive or are not in satisfactory growing condition, as determined by the Landscape Architect, without additional cost to Owner. The Landscape Architect may reject plants before and/or after planting.
3. Labeled. Label at least one tree and one shrub of each species with a securely-attached, waterproof tag bearing legible designation of botanical and common name.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the site, verify grade elevations, and observe conditions under which work is to be performed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner's Representative.
- B. Proceed with complete landscape work as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required.
- C. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand-excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- D. When conditions detrimental to sod or plant growth are encountered, such as rubble fill, adverse drainage condition, or other obstructions, notify the Owner's Representative before planting.

3.02 PREPARATION

- A. Soil Testing
 1. Coordinate soil testing in an expeditious and timely manner as required for on-site topsoil materials. Contract with a soil laboratory and include cost of sampling and testing in contract price. Take one (1) sample for every 5,000 square feet of landscape area up to a maximum of six (6) samples under the direction of and in the presence of the Owner's Representative.
 2. Submit each sample, according to the quantity of soil required by testing laboratory, to a competent laboratory approved by the Owner's Representative.
 3. Provide analysis of soil samples for pH, salinity, ammonia, phosphate, potassium, calcium, magnesium, boron, and sodium levels. Provide appraisal of chemical properties, including particle size determination, and recommendations for types and quantities of amendments and fertilizers.
- B. Clearing of Vegetation:
 1. If live perennial weeds exist on site at the beginning of work, spray with a non-selective systemic contact herbicide as recommended and applied by an approved licensed

landscape pest control advisor and applicator. Leave sprayed plants intact for at least 15 days.

2. Clear and remove existing weeds by mowing or grubbing off all plant parts at least one-quarter inch ($\frac{1}{4}$ ") inch below surface of soil over entire areas to be planted.

C. Soil preparation:

1. Loosen soil in all planting areas, and on slopes flatter than 3:1 gradient, to a depth of six to eight inches (6" - 8") below finish grade. All debris, foreign matter, and stones shall be removed prior to the placing of any fertilizers or conditioners. Soil preparation is for all shrub planting beds, lawn hydroseeded areas and sodded lawn areas.
2. Conduct the required soil tests and instruct the lab to include a minimum of the following soil improvements in the recommendation on the soils report.
 - a. Soil Amendment: Two cubic yards (2 cy) per 1,000 square feet.
 - b. Gro-Power Plus: One hundred fifty pounds (150 lbs) per 1,000 square feet.
 - c. If the lab recommends less than six cubic yards (6 cy) of soil amendment, the excess bid amount shall be applied to the cost of any additional recommended soil improvements, or returned to the Owner as a credit
3. Apply amendments as follows, using rates recommended by the soils testing laboratory (the rates of amendments shown below are for bidding purposes only):
 - a. Fertilizer/Soil Conditioner: Broadcast 150 pounds of Gro Power Plus per 1,000 square feet in all planting areas and rototill to a depth of six to eight inches (6" - 8"). Remove from the site any rock and debris brought to the surface by cultivations. "Cultipack" all areas to receive sod or hydroseed.
 - b. Apply soil amendment to all planting areas at the rate of six cubic yards (6 cy) per 1,000 sf and rototill into the top six to eight inches (6" – 8").
4. Upon completion of finish grading, request a review and obtain approval of Landscape Architect prior to commencement of planting or hydroseeding.

D. Finish Grading for all Planting areas

1. Refer to Earthwork Specification Section for Rough Grading.
2. Grade to elevations and contours shown on Drawings. Fill low spots with landscape backfill material and grade to surface drain in manner indicated on Drawings.
3. Finish-grade so that the entire area within the contract lines has a natural and pleasing appearance as specified and as directed by Landscape Architect.
4. Adjust sprinkler heads flush to finish grade in preparation to receive hydroseeding or one-half inch above finish grade in preparation to receive sod. Reset sprinkler heads flush to grade after turf has germinated.
5. Flag the sprinkler heads and valve markers.

E. Planting Pits for Trees:

1. Excavate pits with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.
2. Set container-grown stock in center of pit on earth pedestal. Separate roots and/or prune roots as directed by Landscape Architect. In hot weather, pre-wet pit. Loosen outside

roots from sides and bottom of root ball. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Water after placing final layer of backfill.

3. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.
4. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

F. Planting Pits for Shrubs/Groundcover:

1. Excavate pits and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.
2. Loosen hard subsoil in bottom of excavation. Extend excavation as required to insure proper drainage from plant pits.
3. Fill excavated planting pits with water to half the depth of pit. Pits should drain within four hours (4 hrs). If planting pits do not drain, notify Project Inspector immediately. Do not proceed with planting until Landscape Architect has resolved a method to provide drainage.

3.03 INSTALLATION

A. Root Barrier

1. Root barriers location are specifically shown on the plan. If a tree is moved during construction to a location where root barrier is not shown on the plan, the following minimum requirements are to be met:
 - a. Install root barrier where trees are planted within sixty inches (60") of paving or other hardscape elements, such as walls, curbs, and walkways.
 - b. Install root barrier continuously for a distance of five feet (5') in each direction from the tree trunk, for a total distance of ten feet (10') per tree. If trees are spaced closer, use a single continuous piece of root barrier.
2. Align root barrier vertically and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.
3. Position top of root barrier just below the top of adjacent hardscape element but above finish grade of the soil so that is visible.
4. If there are concrete spoils or overpour that is impeding the root barrier from being installed directly adjacent to the hardscape element, the contractor is to remove the extra concrete in a manner that does not damage the integrity of the hardscape element.
5. Do not distort or bend root barrier during construction activities.
6. Do not install root barrier surrounding the root ball of tree.

B. Trees, Shrubs, and Groundcover:

1. Lay out individual tree and shrub locations and areas for multiple plantings. Stake the locations, outline the areas, and secure the Owner's Representative's acceptance before

- beginning the planting work. Make minor adjustments as requested.
2. Scarify root ball prior to planting. Plant in holes twice the diameter of the root ball and to a depth equal to the container's height. Place the shrub and/or groundcover so the top of the root ball is one inch (1") higher than the surrounding grade; place the tree so that the crown of the trunk is two inches (2") higher than the surrounding grade. Set container-grown stock in center of pit. In hot weather, pre-wet the pit. When set, place additional backfill around base and sides of root ball. Work each layer to settle backfill and eliminate voids and air pockets. Thoroughly compact lower half of backfill in plant pit. See staking or guying detail. Water after planting. Provide a berm or watering basin for each tree. Add Vitamin B-1, in the proper solution as recommended by the manufacturer, to the second watering of the basin.
 3. Place fertilizer planting tablets in root zone and alongside each plant. Follow manufacturer's instructions for number of tablets to use for each container size.
 4. See Drawings for additional information.
 5. Grooming and Staking of Trees:
 - a. Prune, thin-out and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Landscape Architect, do not cut tree leaders, and remove only injured or dead branches from flowering trees.
 - b. Paint cuts over one-half inch (½") in size with standard tree paint or compound, covering exposed, living tissue. Use paint that is waterproof, antiseptic, adhesive, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants. Do not use shellac.
 - c. Stake or guy trees immediately after planting, as indicated on Drawings.
 6. Grooming of Shrubs:
 - a. Prune, thin-out and shape shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character and to accomplish their use in landscape design. The required plant size is its size after pruning.
 - b. Remove and replace excessively pruned or malformed new plants resulting from improper pruning.
 7. Request review by the Landscape Architect after locating, but prior to planting all trees. Under the direction of the Landscape Architect, make slight adjustments to plant material location as necessary to reflect original intention of Drawings.

C. Weed Control

1. Apply pre-emergent weed control to all planting areas (except lawn) after completion of all planting and one complete watering. Follow manufacturer's directions. To prevent washing away of weed control, do not over-water after its application. Do not allow any weed control into lawn areas. Treat any existing noxious weeds, such as Johnson grass, with Roundup in successive treatments until all roots are destroyed, then remove all grass and roots. Notify Owner's Representative of time of installation for verification of application.

D. Bark Mulch

1. Apply mulch at the rate of three inches (3") deep to all planting areas, exclusive of lawn,

after the planting and weed control are completed. Twelve inches (12") from planter edges, taper full depth of mulch to meet adjacent grades. Do not place mulch within three inches (3") of trunk or stems.

E. Erosion Control Blanket

1. When planting operations have been completed and finish-grade has been re-established, request review of surface grade, and obtain approval of Landscape Architect before installation of blanket. Install material as per Drawings.

F. Jute Mesh

1. Jute mesh shall be installed at the locations shown on the plans.
2. Jute mesh shall be placed after cultivation and before planting. Soil surface should be reasonably smooth, remove rocks or other obstructions that rise above the level of the soil. Jute mesh shall be placed loosely on the finish grade up and down the slope in a manner to fit the soil surface contour and shall be held in place staples driven vertically into the soil at approximately 24" spacing and no more than 12" when overlapping mesh. Jute mesh strips shall be overlap along the sides by at least 6" and if more than one roll is required going down the slope, the ends going down the slope should overlap by at least 3'. Ends of strips shall be tucked into the soil by at least 6".

3.04 CLEANING

- A. During construction, keep the site free of rubbish and debris, and clean up the site promptly when notified to do so. Take care to prevent spillage on streets from hauling and immediately clean up any such spillage and/or debris deposited on streets due to the work of this Section.
- B. During all phases of the construction work, take all precautions to abate dust nuisance by clean-up, sweeping, sprinkling with water, or other means as necessary.

3.05 PROTECTION: MAINTENANCE

- A. The Landscape Maintenance Period will begin when all the Landscape Maintenance Period Requirements have been met (See Part 1 of these Specifications).
- B. Cleaning: Maintain cleanliness on paving areas and other public areas used by equipment and immediately remove all spillage. Remove from project site all rubbish and debris found thereon and all material and debris resulting from landscaping work, leaving the site in a safe and clean condition.
- C. Maintenance:
 1. Sprinkler Irrigation System:
 - a. Check system weekly for proper operation. Flush lateral lines out after removing last sprinkler head or two at each end of lateral. Adjust all heads as necessary for unimpeded coverage.
 - b. Set and program automatic controllers for seasonal water requirements. Provide

- the Owner's Representative with keys to the controllers and instructions on how to turn off system in case of emergency.
- c. Repair all damages to sprinkler irrigation system as part of the contract work. Make repairs within one watering period or one week, whichever is the least amount of time.
2. Trees and Shrubs:
 - a. Water enough that moisture penetrates throughout root zone and only as frequently as necessary to maintain healthy growth.
 - b. Construct and/or remove water basins around each plant, depending on the time of the year and as directed.
 - c. Do not prune unless directed by the Landscape Architect.
 - d. Re-stake and re-tie trees as needed and as directed by the Landscape Architect. Do not allow tops of tree stakes to protrude into head of tree.
 - e. Replace any dead, dying or vandalized plant material on a weekly basis throughout the Landscape Maintenance Period.
 3. Insecticide and Herbicide Application:
 - a. If needed, control weeds with selective herbicides and sprays. In areas where crabgrass has infested the lawn, apply pre-emergent herbicides such as Dacthal by Amvac, Balan, or Betasan by Gowan for control prior to crabgrass germination. Control insect pests if necessary.
 - b. Use only a licensed Pest Control Operator to apply herbicides and sprays and to maintain a log for applications indicating material, timing, and rate.
 4. Pre-scheduled On-site Meetings: Hold regularly-scheduled (monthly or bimonthly as determined by the Landscape Architect) on-site meetings with the Landscape Architect, Project Inspector and Owner's Representative. Dates and times will be jointly agreed upon.
 5. Request, forty-eight hours (48 hrs.) in advance, on-site visits by the Landscape Architect to determine the end of the Landscape Maintenance Period.

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SECTION 32 92 00

TURF PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 SUMMARY:

- A. This Section includes the following:
 - 1. Sodding.
- B. Related Sections include the following:
 - 1. Specification Section 01 33 00 "Submittals" for product submittals.
 - 2. Specification Section 31 00 00 "Earthwork" for excavation, filling and backfilling, and rough grading.
 - 3. Specification Section 32 90 00 "Landscaping" for planting.
 - 4. Specification Section 33 40 00 "Site Drainage" for subsurface drainage.

1.3 DEFINITIONS:

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Import Topsoil: Shall be obtained from a local source and coming from a site with similar soil characteristics as the project site. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones and rocks and other extraneous or toxic matter harmful to plant growth.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending nutrients, minerals, soils or sand with stabilized organic soil amendments to produce surface planting soil capable of sustaining plant growth.
- D. Planting Soil: On-site topsoil, import topsoil or manufactured topsoil.
- E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath topsoil.
- F. On-site Topsoil: Naturally occurring, on-site, surface soil, usually occurring in the top four (4) to twelve (12) inches of original, undisturbed surface soil containing organic material, necessary nutrients and minerals to sustain plant growth and be approved to sustain plant life by an approved soil and plant life by an approved soil and plant lab.

- G. Substantial completion for landscape and irrigation: Work shall be considered substantially complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications with only minor adjustments required and approval has been submitted in writing by Owner's Representative.
- H. Final completion for landscape and irrigation: Work shall be considered complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications and the maintenance period has been completed per plans and specifications and approval has been submitted in writing by Owner's Representative.

1.4 SUBMITTALS:

- A. Product and Material Data: For each type of product specified. Submit manufacturer's technical data and installation instructions for landscape products conforming to requirements of Section 01 34 00 "Submittals, Shop Drawings, Project Data" to include, but not be limited to:
 - 1. Analysis of proposed soil amending materials by soil analysis laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
 - 2. Samples for Verification: For each of the following:
 - a. Nitrogen stabilized organic soil amendment (1/2 c.f. each).
 - 3. Certification of turfgrass sod, identifying source, including name and telephone number of supplier.
 - 4. Material Test Reports: For on-site topsoil, import topsoil and/or manufactured soil proposed for use on this project.
 - 5. Planting soil amendments as recommended by soil analysis laboratory.
- B. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer shall be delivered to Owner's Representative upon delivery.
- C. Qualification Data: For landscape Installer prior to performing work.
- D. Planting Schedule: Indicating anticipated planting dates for turf installation.

1.5 QUALITY ASSURANCE

- A. Inspection Requirements: Conform to Specification 32 90 00 "Landscaping" for "inspection requirements" such as meetings, incremental verifications and approvals and additional maintenance requirements.
- B. Installer Qualifications:
 - 1. Experience: The turf installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.

2. Licensure: The turf installation firm shall hold a current, active C27 "Landscaping Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
 3. Supervision: The turf installation firm shall have a qualified and experienced turf technician on site during turf installation.
- C. Soil Analysis Laboratory Qualifications: Analysis laboratory shall be Lucchesi Plant and Soil Consulting, LLC., www.lucchesiconsulting.com, (408) 337-2575, or approved equal independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the analysis indicated and that specializes in types of tests to be performed.
- D. Soil Testing: Coordinate soil testing in an expeditious and timely manner as required for on-site topsoil materials. Contract with a soil laboratory and include cost of sampling and testing in contract price. Take one (1) sample for every 5,000 square feet of landscape area up to a maximum of six (6) samples under the direction of and in the presence of the Owner's Representative.
- E. Soil Analysis: Furnish soil analysis by a qualified soil analysis laboratory stating:
1. Percentages of organic matter.
 2. Gradation of sand, silt, and clay content.
 3. Cation exchange capacity (CEC) or total exchangeable cations (TEC).
 4. Sodium absorption ratio.
 5. Deleterious material.
 6. pH.
 7. Soluble salts, boron, mineral and plant-nutrient content.
 8. Report suitability of planting soil for plant growth.
 9. State recommended quantities of nitrogen, phosphorus and potash nutrients and soil amendments to be added to produce a satisfactory planting soil.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
- G. Protect all lawn areas from damage or trespass by maintaining construction fencing during construction and maintenance.
- 1.6 DELIVERY, STORAGE, AND HANDLING:
- A. Sod: Harvest, deliver, store, and handle sod according to requirements in Turf Producers International's (TPI) "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."
- 1.7 SCHEDULING:
- A. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE:

- A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Sodded Lawns: Maintenance period shall be a minimum of ninety (90) days from date of Owner's Representative written approval of Substantial Completion and when there are no visible joints or bare patches, roots are thoroughly knit to the soil and sod appears to be uniformly healthy and green in color.
- B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and spraying for insects and disease and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Implement pest management as necessary to controls pests, including gophers.
 - 1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.
- C. Watering: Provide and/or maintain temporary piping, hoses, and lawn-watering equipment as necessary to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.
 - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of mulch.
 - 2. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
- D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one third (1/3) of grass height. Remove no more than one third (1/3) of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
 - 1. Mow and edge before turf reaches three and one-quarter (3-1/4) inches high.
 - 2. Cut to two and one-half (2-1/2) inches high.
 - 3. Remove all clippings.
- E. Lawn Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.
 - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.
- F. Maintain protective barriers in place, erect and secure and clear of lawn edges to allow for uniform growth and for trimming and so as not to block irrigation spray pattern.

1.9 WARRANTY:

- A. All work executed under this Section shall be warranted free of defects and poor workmanship for a period of one (1) year after date of Final Completion.

- B. Turf planting shall be warranted to be in healthy and thriving condition during Warranty period, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor's control.
- C. Repair and/or re-sod turf areas not in vigorous condition immediately upon notification by Owner's Representative during Warranty period.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD:

- A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Not less than 2 years old, free of weeds and undesirable native grasses and machine cut rolls to pad thickness of 5/8 inch.
- B. Turfgrass Species: Sod of grass species as follows, with not less than 90 percent germination, not less than 95 percent pure seed, and free of weed seed:
 - 1. Sod: 100% Hybrid Bermuda "Tiffway 419 & Tifway II" grown on degradable netting, available from Delta Bluegrass, www.deltabluegrass.com, (800) 637-8873.
- C. Delivery, Storage and Handling: Sod shall be harvested, delivered and installed within a period of 24 hours. Sod shall be kept moist, fresh and protected at all times.

2.2 PLANTING SOIL:

- A. Prior to placing bid, Contractor to coordinate with General Contractor, Demolition and/or Grading Contractors and verify quantity and source of planting soil for turf planting areas. Identify Contractor responsible for stockpiling on-site topsoil and/or acquiring import planting soil and installing a minimum of six (6) inches of planting soil in turf planting areas and rough grading in accordance with these specifications, details, notes, grading and drainage plans.
- B. Coordinate with General Contractor, Demolition and/or Grading Contractors for removal and replacement of any lime treated soils and replacement with planting soil prior to planting turf to depth required to remove lime treatment.
- C. On-site topsoil: Reuse existing topsoil or existing surface soil, top twelve (12) inches, excavated and stockpiled on-site. Verify suitability of stockpiled surface soil to produce planting soil by submitting a sample to a soil analysis laboratory. Acceptable on-site topsoil shall be ASTM D 5268, pH range of 5.5 to 7.5, representative of productive soils in the vicinity, a range of 4 to 15 percent organic material content; free of stones one (1) inch or larger in any dimension, roots, plants, sod, clay lumps and other extraneous materials harmful to plant growth. Sodium absorption rate (SAR) shall not exceed 5.0, conductivity of the saturation extract solution shall not exceed 3.0, and boron concentration in the saturation shall not exceed 1.0 ppm. Fine gravel (2-5 mm) and coarse gravel (5-12 mm) content shall not exceed 30%.

- D. Import Topsoil: Supplement with imported or manufactured topsoil from off-site, local sources, when quantities of on-site topsoil are insufficient. Do not obtain topsoil from bogs or marshes. If soil is obtained from agricultural land, Contractor shall submit proof soil is nematode free. Import topsoil shall meet the following requirements:
1. USDA Classification of fraction passing 2.0 mm sieve: sandy loam, sandy clay loam or loam.
 2.

Class	Particle size range	maximum, %	minimum, %
Coarse Sand	0.5 – 2.0 mm	15	0
Silt	.002-.05 mm	30	10
Clay	<.002 mm	25	10
Other Classes			
Gravel	2-13 mm	15	4
Rock	½-1 inch	5% by volume with none >1 inch	
Organic		15	0
 3. Chemistry – Suitability Considerations

Salinity: Saturation Extract Conductivity (ECe)
Less than 3.0 dS/m @ 25 degrees C.

Sodium: Sodium Adsorption Ratio (SAR)
Less than 6.00 ppm

Boron: Saturation Extract Concentration
Less than 1.00 ppm

Reaction: pH of Saturated Paste: 5.5 – 7.5 without high lime content.
 4. Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials prior to planting.
 5. Soil Analysis: Contractor shall submit to the Owner’s representative for approval, certification from an agricultural soils analysis laboratory that the import topsoil provided conforms to the specifications prior to delivery of import or placement of on-site topsoil. Soil analysis shall have been performed on import topsoil source within the previous year.

2.3 FERTILIZER AND SOIL AMENDMENTS:

- A. Contractor shall collect and submit sample of proposed planting soil, representative of the top eight (8) inches of planting soil, to a locally known laboratory for analysis and amendment recommendations. Sample shall be representative of typical on-site topsoil proposed for use in planting areas.
- B. If import topsoil is proposed, import topsoil sample shall be submitted to a soil analysis laboratory locally known for analysis, amendment recommendations and installation recommendations.

- C. Contractor shall provide soil analysis laboratory, the following information when submitting soil for analysis:
 - 1. Project type (public school, commercial building, etc.).
 - 2. Anticipated maintenance (regular, low, none, etc.).
 - 3. Irrigation water source (potable or recycled).
 - 4. Proposed plant material type such as ornamental or sport turf.
 - 5. Copy of this specification.
 - D. Fertilizers: All fertilizers shall be of an approved brand with a guaranteed chemical analysis as required by USDA regulations and shall be dry and (except for plant tabs) free flowing.
 - E. Nitrogen Stabilized Organic Amendment: 0-1/4 inch nitrogen-stabilized organic amendment contributing at least 270 pounds of organic matter per cubic yard. Consider using Composted Greenwaste Organic Soil Amendment, such as Z-Best Organic Compost from Zanker Landscape Materials (www.zankerlandscapematerials.com) or equal, if recommended by soil analysis laboratory. Compost shall be obtained from a supplier participating in the Seal of Testing Assurance (STA) program of the U.S. Composting Council.
 - 1. In order to comply with MWEL0 492.6, 3. (C). Soil Preparation, Mulch and Amendments, at a minimum, compost shall be applied at a rate of four (4) cubic yards per 1,000 square feet of permeable area incorporated to a depth of six (6) inches into the soil. Soils with greater than 6% of organic matter in the top six (6) inches are exempt from adding compost.
 - 2. Nitrogen stabilized sawdust shall not be used.
 - F. Soil Preparation: The following materials and quantities are given for bidding purposes only and Contractor shall amend soil using products, quantities and methods specified by soil analysis laboratory.
 - 1. Nitrogen stabilized organic amendment.
 - 2. Starter fertilizer, XB Best 6-20-20 or 6-24-24.
 - 3. Soil sulfur.
- 2.4 HERBICIDES:
- A. All herbicides shall be approved by the District prior to use.
 - B. Contractor shall contact Owner's Representative prior to application of herbicides for Owner's policies, rules and regulations pertaining to herbicide application.
 - C. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove broad-leaf weeds from existing turf.
 - D. Non-selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove herbaceous vegetation in areas indicated.

2.5 WATER:

- A. Water shall be suitable for irrigation and free from ingredients harmful to sodded areas.

2.6 LANDSCAPE EDGINGS/HEADERBOARD:

- A. Wood Strip Edging, unless indicated otherwise on Drawings, shall be as follows:
 - 1. Species: Construction Heart Redwood, size per detail.
 - 2. Stakes: Construction heart redwood, size per detail, with galvanized nails for anchoring edging.
 - 3. Splice Plate: Same species as edging, 1 by 6 by 24 inches long in nominal size, with galvanized nails for securing in place.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Planting operations shall be performed when weather and soil conditions are suitable for planting.

3.2 PREPARATION:

- A. Add site clearing and rough grading requirements here if subgrade preparation is not included in Division 2 Sections "Site Clearing" and "Earthwork."
- B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- D. Install protective barriers and/or fencing as necessary.
- E. Contact and obtain Owner's Representative, Local, State and Federal policies and procedures for regulating application of fertilizers, fungicides, insecticides, pesticides and herbicides. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.
- F. Import Planting Soil Installation:
 - 1. Remove and dispose of stones larger than one (1) inch in any dimension, vegetation and foreign inorganic material from surface to receive import topsoil.
 - 2. Scarify or plow the subgrade by crossripping or equivalent to a minimum depth of four (4) inches until it is loose and uncompacted to provide bonding of imported topsoil layer to subgrade.

3. Place topsoil on loosened material in six (6) inch layers. Crossrip first import topsoil layer to a depth of eight (8) inches and blend import topsoil with loose native surface soil. Roll lightly with appropriate lawn roller to consolidate topsoil and compact to 85% density.
 4. Continue placement of import topsoil after blending first layer with native soil in six (6) inch layers and rolling lightly to consolidate and compact each layer of topsoil.
 5. Place topsoil to the lines and grades in accordance with grading Drawings.
- G. Verify installation of planting soil to minimum depth of six (6) inches and rough grading completed to proper slopes and elevations.
- H. Verify lime treated soils have been removed and replaced with acceptable planting soil.

3.3 SOIL AMENDING AND FINE GRADING (Amend per Soil Analysis Laboratory recommendations. The following recommendations are given for bidding purposes only.):

- A. Prior to disturbing soil, apply non-selective herbicide to eradicate vegetation. Select herbicide(s) most appropriate for vegetation to remove. Follow manufacturer's recommendation for complete kill prior to continuing work, approximately two (2) days. Re-apply in event herbicide is washed off by rain or water and as required for complete eradication of vegetation.
- B. Soil Preparation: Loosen subgrade of planting beds by cross-ripping or equivalent cultivation to a minimum depth of ten (10) inches. Remove stones larger than one (1) inch in any dimension and sticks, roots, rubbish, and other extraneous matter in the top six (6) inches of soil and legally dispose of them off Owner's property.
- C. Soil Amending: (Amend per Soil Analysis Laboratory recommendations. The following recommendations are provided for bidding purposes only.) Add the following and thoroughly till into the top six (6) inches of planting soil at the following rates per 1,000 square feet. Till planting soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Float, rake and roll all planter areas to establish finished grades, maintaining drainage patterns and swales for grading and drainage plans, creating smooth, uniform surface plane.
1. 6 cubic yards nitrogen stabilized organic amendment.
 2. 15 pounds soil sulfur.
 3. 15 pounds Starter fertilizer, XB Best 6-20-20 or 6-24-24.
- D. Fine Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Refer to civil grading plans and conform to designed grades, drainage patterns, swales, and ridges. There shall be no areas that hold water or drain toward buildings or structures, unless designed per civil grading plans.
1. In sodded turf areas, one (1) inch below adjacent paved surfaces, utility boxes, tops of curbs, etc.
- E. Moisten prepared lawn areas before planting if planting soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil conditions.

- F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.
- G. Compact soil to 85% density.
- H. Apply starter fertilizer at manufacturer recommended rates.

3.4 SODDING:

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted planting soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
 - 1. Lay sod across angle of slopes exceeding 1:3.
 - 2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
 - 3. Hold sod clear of all tree trunks and tree staking, create a circular edge 12" clear of all tree trunks.
- C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist planting soil to a minimum depth of 1-1/2 inches below sod.

3.5 MAINTENANCE SCHEDULE:

- A. Protection: Protect work from damage, erosion and trespass. Maintain construction fencing in proper condition. Remove temporary fencing and/or barriers prior to final completion and at end of maintenance period.
- B. Water: Contractor shall be solely responsible for ensuring that all planting is sufficiently watered to promote vigorous growth. Test and inspect irrigation system on a regular basis, each week during plant establishment and monthly thereafter. Adjust and repair the irrigation system and its components as necessary for turf establishment and growth and for watering efficiency. Check and adjust any obstructions to emission devices.
- C. Fertilizing (confirm with soil analysis laboratory recommendations): Immediately after completion of planting, fertilize landscape areas with ammonium sulfate (21-0-0) fertilizer at a rate of five (5) pounds per 1000 square feet. Fertilize with specified fertilizer after 45 days, prior to end of maintenance period. After landscape becomes well-established, fertilize in fall and spring with (16-6-8) commercial fertilizer at a rate of six (6) pounds per 1000 square feet.
- D. Weed Control: Maintain turf planting areas in a weed-free condition to be performed weekly during maintenance period. Weeding may be done manually or by the use of selective herbicides. (Contractor shall obtain written approval from project Owner's Representative prior to application of herbicide). No herbicide shall be used without the Owner's Representative's prior consent. Use

only approved herbicides, use in accordance with manufacturer's recommendations and per Pest Control Advisor's recommendations. If selective herbicides are used, extreme caution shall be observed so as not to damage any other plants. Spraying shall be done only under windless conditions.

- E. Lawns: Maintain lawns by watering, fertilizing weeding, trimming, mowing and other operations such as rolling, re-grading and replanting as required to establish a smooth, acceptable lawn, free of weeds, bare spots and rocks. All lawn areas shall be mowed regularly when grass reaches a height of three and one-quarter (3-1/4) inches and a minimum of two (2) days prior to end of maintenance period.
- F. Disease, Pest and Insect Control: Disease, pest (including moles, gophers and geese) and insect damage shall be controlled by the use of fungicides, insecticides, pesticides or poisons. Contractor shall obtain written approval from project Owner prior to application of fungicides, insecticides or pesticides and shall abide by all posting requirements prior to application. Review and perform weekly during maintenance period.

3.6 FIELD QUALITY CONTROL, SUBSTANTIAL COMPLETION AND FINAL COMPLETION:

- A. Contact Owner's Representative a minimum of 48 hours prior notice for review and approval of the following prior to proceeding with subsequent work:
 1. Preparation: at completion of finish grading and prior to planting, grading tolerances and soil preparation shall be checked for conformance to Drawings and as specified herein.
 2. Layout: Layout of sod, headerboard and other major elements shall be directed and/or approved by the Owner's Representative.
 3. Substantial Completion Review (Pre-maintenance review): At substantial completion of this Section, work shall be reviewed for conformance with the Drawings. Written approval shall mark beginning of the maintenance period.
 4. Final Completion Review (Final Review): At the end of specified maintenance period, work shall be reviewed for conformance with Drawings including additional requirements stipulated during maintenance period shall be extended at Contractors sole cost as directed by the Owner's Representative.
 5. Re-inspections required due to Contractor not being prepared or non-conformance to Drawings shall be back charged to the Contractor.
- B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory and upon written approval of Owner.

3.6 CLEANUP AND PROTECTION:

- A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

- B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.
- C. Remove erosion-control measures after grass establishment period.

END OF SECTION

SECTION 33 00 00

SITE UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Domestic water piping system.
2. Fire protection piping systems.
3. Sewer piping system.
4. Other water and sewer items that may be specified or shown on the drawings.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 16 00, Site Concrete.
5. Section 33 00 00, Earthwork.

1.02 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.
- I. NFPA 13, 24 and 25, latest editions as adopted by 2022 CBC chapter 35 and 2022 CFC chapter 80.
- J. California State Health and Safety Code Section 116875, Lead Free Public Water Systems.

K. California Plumbing Code, 2022 edition.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- C. Provide sieve analysis from accredited testing lab on pipe bedding material. Analysis shall have a current date not older than project contract signing date.
- D. Substitution: Provide all data of proposed material being submitted as a substitution. Provide comparison with specified product data and identify all differences. Failure to provide comparison will be reason for rejection.

1.04 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the drawings to be salvaged and re-used.
 - 1. Sun damaged or discolored PVC pipe will be rejected.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects or deficiencies discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
- D. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction or incorrect grades will be the responsibility of the contractor.
- E. Per 2022 NFPA 13 provide Contractor's material and test certificate to the Owner, Architect, Project Inspector and Local Fire Authority.

1.05 FEES, PERMITS, AND UTILITY SERVICES

- A. Obtain and pay for permits and service charges required for installation of Work. Arrange for required inspections and secure written approvals from authorities having jurisdiction.
- B. Upon completion of work within right-of-way, provide copies of written final approval to the Architect.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.
- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.08 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.09 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gulying of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to provide pumps and all equipment necessary to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.
- H. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

1.10 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.11 RECORD DRAWINGS

- A. Keep a daily record of all pipe placed in ground, verified by Project Inspector.
- B. Upon completion of this Contract, furnish one tracing showing all outside utility lines, piping, etc., installed under this Contract. Locate and dimension all work with reference to permanent landmarks.
- C. All symbols and designations used in preparing "RECORD" drawings shall match those used in Contract drawings.
- D. Properly identify on as-builts and provide dimensions for all stubs for future connections. Provide concrete markers 6" dia. 12" deep, flush with finish grade at the ends of all stubbed pipes.

PART 2 – PRODUCTS

2.01 MATERIALS - GENERAL

- A. Provide each item listed herein or shown on drawings of quality noted or approved equal. All material shall be new, full weight, standard in all respects and in first-class condition. Insofar as possible, all materials used shall be of same brand or manufacture throughout for each class of material or equipment. Materials shall be of domestic manufacture and shall be tested within Continental United States.
- B. Grade or quality of materials desired is indicated by trade names or catalog numbers stated herein.
- C. Dimensions, sizes, and capacities shown are minimum and shall not be changed without permission of Architect.
- D. All materials in this section used for any public water system or domestic water for human consumption shall be lead free.
 - 1. For the purposes of this section, "lead free" means not more than 0.2 percent lead when used with respect to solder and flux and not more than 8 percent when used with respect to pipes and pipe fittings.
 - 2. All pipe, pipe or plumbing fitting or fixtures, solder, or flux shall be certified by an independent American National Standards Institute (ANSI) accredited third party, including, but not limited to, NSF International, as being in compliance with this section.

- E. All materials used for fire system piping shall be UL and FM approved.

2.02 VALVE BOXES

- A. For valves 4" and larger: Provide at each valve or cock in ground a Christy, Brooks, or equal to Christy G05CT, concrete traffic rated valve box with steel/cast iron bolt down cover marked for service, domestic water shall be marked "Water" and fire supply shall be marked "Fire". Furnish extension handles for each size square nut valve, and provide "fork" handle for each size of "wheel handle" valve as required. Do not locate valve boxes in walk, or covered passages, curbs, or curb & gutters, unless necessary. If valve location is within concrete or asphalt paved surface valve box shall be as detailed on plans for such condition. Valve boxes to be traffic rated regardless of location and all valve boxes installed in planting areas shall have 12" wide 6" thick concrete collar. Provide valve box extensions as required to set bottom of valve box to bottom of piping in which valve is installed. Provide Owner with set of special wrenches and/or tools as required for operation of valves.
- B. For valves 3" and smaller: Provide at each valve or cock in ground, a traffic rated valve box with steel/cast iron bolt down cover marked for service, domestic water shall be marked "Water". Valve boxes shall be sized based on valve size per the table below. Valves shall be installed such that the entire valve assembly can be reached by hand from grade, meaning the top of valve head is no less than 12" from the bottom of valve cover, and no greater than 24". Provide fittings in water line to raise line elevation to meet this depth criteria per the plan detail. Do not locate valve boxes in walk, or covered passages, curbs, or curb & gutters, unless necessary. All valve boxes to be traffic rated, regardless of location. If installed in planter areas, provide 12" wide 6" thick concrete collar. Provide valve box extensions as needed to provide depth per plan details.
 - a. Valves ½" - 3/4" = Christy B1017 or approved equal.
 - b. Valves 1" – 2" = Christy B1324 or approved equal.
 - c. Valves 2.5" – 3" = Christy B1730 or approved equal.
 - d. Other specialty water valves/appurtenances = Select valve box that allows "device" to fully fit within the box including unions, Christy B1017 thru B3048, or approved equal.

2.03 PIPES AND FITTINGS

- A. Sanitary Sewer: PVC sewer pipe and fittings with Ring-Tite joints, ASTM D3034 SDR35.
- B. Domestic water Lines 3 1/2" and smaller: Type K copper tubing, hard temper, with wrought copper fittings.
- C. Water lines 4" and larger: AWWA C-900 Class 150/DR18 with rubber gasket joints.
- D. Fire lines 4" and larger: AWWA C-900 Class 200/DR14 with rubber gasket joints.
- E. Solder: Lead Free. 95/5; 95% Tin / 5% Antimony.
- F. Ductile Iron Pipe; Class 350, Cement Lined
- G. Ductile Iron Pipe Fittings; AWWA C110, C153, Ebba Iron, Star Romac, Sigma, or approved equal.

- H. Mechanical Fitting Bolts; Bolts and nuts shall be carbon steel with a minimum 60,000 psi tensile strength conforming to ASTM A 307, Grade A. Bolts shall be standard ANSI B1.1 Class 2A course threads. Nuts shall conform to ASTM A 563 and be standard ANSI B1.1, Class 2A course thread. All bolts and nuts shall be zinc coated.
- I. Fasteners Anti-Rust Coatings; After assembly, coat all fasteners with an Asphaltic Bituminous coatings conforming to latest edition NFPA 24.
- J. Ductile Iron Pipe Wrap; 8 mil polyethylene pipe wrap conforming to ANSI/AWWA C105/A21.5 standards.
- K. Pipe Insulation; Pipe exposed to atmospheric conditions ½" thru 4" NPT; Johns Manville rigid fiberglass insulation, Micro Lok HP; Owens Corning Fiberglas SSL II; Conforming to ASTM C 612, Type 1A or type 1B.
- L. Aluminum field applied pipe insulation jacket; comply with ASTM B209, ASTM C1729, ASTM C1371 Manufacturers; Childers Metals; ITW Insulation Systems Aluminum Jacketing; or an approved equal.
 - 1. Finish shall be flat mill finish
 - 2. Factory Fabricated Fitting Covers; 45 and 90 degree elbows, tee's, valve covers, end caps, unions, shall be of the same thickness and finish of jacket.
 - 3. The fittings shall be composed of 2-pieces
 - 4. Adhesives; per the manufacturers requirements
 - 5. Joint Sealant; shall be silicone, and shall be aluminum in color.
- M. Sewer Forced Main; HDPE, DR 11, color gray with green stripe by JM Eagle or approved equal.

2.04 SANITARY SEWER MANHOLES

- A. Shall be constructed as shown on plan details.

2.05 CLEANOUTS

- A. Cleanouts of same diameter as pipe up to 8" in size shall be installed in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18" from building so as to provide sufficient space for rodding. No horizontal run over 100 feet shall be without cleanout whether shown on drawings or not.
- B. All cleanout boxes shall be traffic rated with labeled lid, Christy G05CT or approved equal. Lid shall be vandal proof with stainless steel screws

2.06 UNIONS

- A. Furnish and install one union at each threaded or soldered connection to equipment and 2 unions, one on each side of valves on pipes ½" to 3".
- B. Locate unions so that piping can be easily disconnected for removal of equipment or valve. Provide type specified in following schedule:

Type of Pipe Union

Steel Pipe:	150 lb. Screwed malleable ground joint, brass, brass-to-iron seat, black or galvanized to match pipe.
Copper tubing:	Brass ground joint with sweat connections.
PVC Sch 80 pipe:	PVC union, FIPT X FIPT

2.07 VALVES

- A. Provide valves as shown and other valves necessary to segregate branches or units. Furnish valves suitable for service intended. Valves shall be properly packed and lubricated. Valves shall be non-rising stem. Place unions adjacent to each threaded or sweat fitting valve. Install valves with bonnets vertical. All valves shall be lead free.
- B. Valves ½" thru 2"; shall be made of bronze, full size of pipe and lead free. Nibco S-113-FL Series; American G-300 Series; Matco 511 FL Series; Apollo 102T-FL Series. Brass valves of brass parts within valves will not be accepted.
- C. Valves, 2 ½" thru 3" shall be class 150; Shall be made of bronze, full size of pipe; Jenkins Fig. 2310 J; Lunkenheimer Fig. 2153; Crane Fig. 437; Stockham Fig. B-128.
- D. Valves, Flanged; 4" thru 12" Ductile Iron Resilient Wedge Gate Valve; Nibco F 609 RW; American 2500 Series; Kennedy 8561; Mueller 2360 Series.

2.07 FIRE HYDRANTS

- A. Clow 960 Factory Painted or per Local Jurisdiction Requirements, or an approved equal, 36" minimum bury, two 2-1/2" hose nozzles, one 4-1/2" pumper nozzle, and break-off check valve, Clow LBI 400A or approved equal . Hydrant shall conform to, and installation shall comply with the Local Jurisdiction.

2.08 POST INDICATOR

- A. Post Indicator shall be Mueller Co. A-20806 (adjustable) with tamper switch or an approved equal.

2.09 BACKFLOW PREVENTERS

Double Check Valve, Double Check Detector and Reduced Pressure Backflow Preventers

- A. Backflow preventers shall be as approved by the local agency and by the State of California's Department of Health Services most recent list of approved reduced pressure backflow preventers. All approved backflow preventers shall have ductile iron bodies.
 - 1. Provide Backflow preventer blankets with locking device. Weatherguard R-30 insulated or equal.
 - 2. Provide ball valve at all test ports with brass plug in valve.
 - 3. Provide a minimum of 2 valve tamper switches on fire prevention Backflows.

2.10 TAPPING SLEEVE

- A. Shall be used on pipe sizes 6" thru 12" and shall be made with stainless steel material including stainless steel bolts. Flanges shall be ductile iron or high carbon steel. Gaskets shall seal full circumference of pipe. Shall be manufactured for operating pressure of 200 psi, and shall pass test pressure of 300 psi. Romac SST series; Smithblair 662; Mueller H304; Ford "FAST" tapping sleeve.

2.11 SERVICE SADDLES

- A. Shall be used on pipe size 2" thru 4". Body shall be made from ductile iron with epoxy coating or bronze. Cascade Style CSC-1; A.Y. McDonald model 3891 AWWA/3892 FNPT; Smith-Blair #317; Ford S70, S71, S90, (style B).

2.11 TRACER WIRE

- A. No. 10 THW solid copper wire. Solder all joints

PART 3 - EXECUTION

3.01 DRAWINGS AND COORDINATION

- A. General arrangement and location of piping, etc., are shown on Drawings or herein specified. Install work in accord therewith, except for minor changes that may be necessary on account of other work or existing conditions. Before excavation, carefully examine other work that may conflict with this work. Install this work in harmony with other craft and at proper time to avoid delay of work.
- B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.
- C. In advance of construction, work out minor changes if conflicts occur with electrical or mechanical. Relocate services to suit actual conditions and work of other trades to avoid conflict therewith. Any adjustments or additional fittings to make adjustments shall not be cause for additional costs to the owner.
- D. Execute any work or apparatus shown on drawings and not mentioned in specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor of furnishing same in place complete.
- E. Graded pipes shall take precedence. If conflict should occur while placing the domestic water and fire service piping, the contractor shall provide any and all fittings necessary to route the water lines over or under such conflicting pipes at no additional costs to the owner.

3.02 ACCESS

- A. Continuously check for clearance and accessibility of equipment or materials specified herein to be placed. No allowance of any kind shall be made for negligence on part of Contractor to foresee means of installing his equipment or materials into proper position.

3.03 EXCAVATING AND BACKFILLING

A. Excavation and Bedding:

1. General: Trench straight and true to line and grade with bottom smooth and free of irregularities or rock points. Trench width to be a minimum of 12" wider than outside diameter of pipe. Follow manufacturer's recommendations for use of each kind and type of pipe.
2. Bedding: Provide a bedding as noted on drawing details for the full length of the pipe. Bedding shall have a minimum thickness beneath the pipe of 4" or 1/8 the outside diameter of the pipe, which ever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.

B. Laying of Pipe:

1. General: Inspect pipe prior to placing. Sun damaged pipe will be rejected. Set aside any defective or damaged material. Do not place pipe in water nor place pipe when trenches or weather are unsuitable. Lay pipe bell up grade, true to line and grade.
 - a. Sewer pipe shall be laid in strict conformity to the prescribed line and grade, with grade bars set and each pipe length checked to the grade line. Three consecutive points on the same rate of slope shall be used at all times to detect any variation from a straight grade. In any case of discrepancy, work shall be stopped and the discrepancy immediately reported to the Owner's Representatives. In addition, when requested by the Owner's Representative, a string line shall be used in the bottom of the trench to insure a straight alignment of the sewer pipe between manholes. The maximum deviation from grade shall not be in excess of 1/4 inch. In returning the pipe to grade, no more than 1/4" depression shall result.
 - b. The Contractor shall expose the end of existing pipe to be extended, for verification of alignment and elevation, prior to trenching for any pipe which may be affected. All costs of such excavation and backfill shall be included in the price paid for the various items of work.
 - c. A temporary plug, mechanical type shall be installed on sewer pipe at the point of connection to existing facilities. If connecting to a public facility the plug shall conform to the requirements of the local jurisdiction. This plug shall remain in place until the completion of the balling and flushing operation.
 - d. Any portions of the new sewer above ground shall be made using no-hub cast iron soil pipe, using no-hub fittings and couplings. The transition from PVC to cast iron shall be made below grade.
 - e. Above ground sewer piping shall be supported using unistrut and the appropriate pipe strap. Unistrut shall be fastened to the building structures wood frame. Unitstrut shall be fastened to the structure using 2- 3/8" X3" lag bolts. Spacing shall be per plumbing code for pipe type and size.
 - f. In cases where above ground sewer cannot be fastened to a structure, the contractor shall use "Doublestrut" unistrut for a pedestal type pipe hanger. The pedestal shall be placed into a pier footing 9" diameter, 18" deep.
 - g. Pedestals shall be spaced no greater than the required pipe hanger spacing schedule for pipe type and size in the CPC Plumbing Code.
2. Bell and Spigot Joints: Lubricate inside of bells and outside of spigots with soap solution. Wedge joints tight. Bell of bell and spigot pipe to be pointed up grade.
3. **All buried metal shall be incased with 8 mil polyethylene wrap so that no soil is in contact with metal. Ends of polyethylene wrap shall be taped to provide seal with pipe.**

C. Backfilling:

1. General: Do not start backfill operations until required testing has been accomplished.
2. Compaction and Grading: Remainder of backfill shall be in accordance with Section 31 23 33 – TRENCHING AND BACKFILLING.
3. Backfill in Areas Previously Lime or Cement Treated:
 - a. If trenching is necessary in areas that have been previously lime treated the contractor shall backfill the trench with class 2 aggregate base from the top of utility initial backfill up to subgrade in accordance with these specifications. **Lime treated soil may not be re-used once it has been compacted and cured. If re-excavated, it must be disposed of.** In Synthetic track and Synthetic Turf areas, following backfill to subgrade, a 13' wide bridging geogrid, Tensar BX 1100 or Tx140 shall be lain centered over trench on subgrade along entire length of the trench. Geogrid may be waived by the onsite geotechnical engineer based on actual soil conditions.

3.04 INSTALLATION OF WATER PIPING

- A. The contractor shall be responsible for determining the installed depth of all water piping, based on surfaces grades and minimum required depth of cover.
- B. Immediately cap or plug ends of, and opening in, pipe and fittings to exclude dirt until final connections made. Use reducing fittings where any change in pipe size occurs. Bushings shall not be used.
- C. General: Should existing conditions or other work prevent the running of pipes or the setting of equipment at the points indicated by drawings, changes as authorized by the Architect shall be made without additional cost to the Owner.
- D. All bolts used on mechanical fittings shall be thoroughly coated with an asphaltic bituminous coating conforming to 2019 NFPA 24, 10.4.1.1.
- E. **All buried metal shall be incased with 8 mil polyethylene wrap so that no soil is in contact with metal. Ends of polyethylene wrap shall be taped to provide seal with pipe.**
- F. Do not install water lines in same trench with non-metallic sewer lines unless bottom of water pipe at all points is at least 12" above top of sewer line and water line is placed on solid shelf excavated at one side of common trench with a minimum of 12 inch horizontal separation.
- G. Under no circumstance shall a fitting be located directly under a structural footing without prior approval from the Architect.
- H. In locations where existing domestic pipe is rerouted, the new pipe shall be assembled using restrained fittings at all joints including factory pipe joints. Tapped restrained blind flanges shall be temporarily installed at each end of the assembled pipes until testing and chlorination is completed and approved.

3.05 CLOSING IN OF UNINSPECTED WORK

- A. Do not allow or cause work installed to be covered up or enclosed before it has been inspected, tested, and approved. Should work be enclosed or covered up before it has been approved,

uncover work at own expense. After it has been inspected, tested and approved, make repairs necessary to restore work of other contractors to condition in which it was found at time of cutting.

3.06 CARE AND CLEANING

- A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in new condition satisfactory to Architect. At completion, carefully clean and adjust equipment, fixtures and trim that are installed as part of this work. Leave systems and equipment in satisfactory new operating condition.
- B. Drain and flush piping to remove grease and foreign matter.
- C. Sewer piping shall be balled and flushed.
- D. Clean out and remove surplus materials and debris resulting from the work, including surplus excavated material.
- E. Flush fire service piping in the presence of the project inspector. Flushing shall be continued for a sufficient time as necessary to ensure all foreign material has been removed. Flow rate shall be equal to site fire flow requirements.

3.07 SEWER INTERNAL INSPECTIONS

- A. Upon completion of construction and prior to final inspection, the Contractor shall clean the entire new pipeline of all dirt and debris. Any dirt or debris in previously existing pipes or ditches in the area, which resulted from the new installation, shall also be removed. Pipes shall be cleaned by the controlled balling and flushing method. Temporary plugs shall be installed and maintained during cleaning operations at points of connection to existing facilities to prevent water, dirt, and debris from entering the existing facility.

3.08 TEST OF PIPING

- A. Pressure Test piping at completion of roughing-in, in accord with following schedule, and show no loss in pressure or visible leaks after minimum duration or four (4) hours at test pressures indicated.
- B. Chlorination tests shall be performed after all fixtures and any required mechanical devices are installed and the entire system is complete and closed up.
- C. In cases where new domestic water piping is assembled for re-routing of existing domestic water pipe, the contractor shall perform the following testing prior to connecting the new water pipe to the existing system.
 - 1. The pipe shall be pressure tested and per the test schedule.
 - 2. The pipe shall be pressure tested down within the trench.
 - 3. The contractor shall dig a temporary ditch below the existing pipe to drain to a sump that is lower than the bottom of the trench and to the side of the trench. The sump shall be 30% larger than the total volume of water within the testing pipe assembly.
 - 4. After pressure testing and chlorination has taken place and accepted, the contractor shall drain the pipe into the sump and pump the sump out as it is filling.
 - 5. The temporary test fittings at each end of the pipe assembly shall be removed and the final

- restrained couplings installed.
6. The existing piping shall be cut and the water within the pipe shall drain below the pipe to the temporary sump. Pump the sump as it is being filled up. Take extreme caution not to contaminate the existing pipe with any contaminants within the trench.
 7. Before making the final coupling connections, the restrained couplings at each end of the new pipe shall be thoroughly swabbed inside the fitting with a solution of chlorine mixed with water at a rate of 1part chlorine to 4 parts potable water.
 8. After final connections are made, a visual inspection shall be made after fittings are wiped off. If after 1 hr, no noticeable drips are noted the pipe can be backfilled.
 9. The contractor shall flush all water piping affected by chlorination until it is within acceptable levels approved by certified testing lab.

TEST SCHEDULE

<u>System Tested</u>	<u>Test Pressure PSIG Test With</u>
Public water mains	Per local jurisdiction requirements.
Private domestic water piping and fire mains serving fire hydrants:	150 Lbs. Water 4 hrs.
Fire Protection Piping from PIV to fire riser:	200 Lbs. Water pressure, 4 hrs duration with no pressure loss.
Sanitary Sewer Piping:	Sewer system shall be tested for leakage per local jurisdiction requirements.

- D. Testing equipment, materials, and labor shall be furnished by contractor.

3.09 WATER SYSTEM STERILIZATION

- A. Public Water Mains: Shall be flushed and disinfected per the local jurisdiction requirements
- B. Clean and disinfect all site water systems connected to the domestic water systems in accordance with AWWA Standard C651 and as required by the local Building and Health Department Codes, and EPA.
 1. Clean and disinfect industrial water system in addition to the domestic water system.
 2. Disinfect existing piping systems as required to provide continuous disinfection upstream to existing valves. At Contractors option, valves may be provided to isolate the existing piping system from the new piping system.
- C. Domestic water sterilization shall be performed by a licensed “qualified applicator” as required by CAL-EPA Pesticide Enforcement Branch for disinfecting and sterilizing drinking water.
- D. Disinfecting Agent: Chlorine product that is a registered product with Cal-EPA for use in California potable water lines, such as Bacticide, CAL-EPA Registration No. 37982-20001.

- E. Contractor to provide a 1" service valve connected to the system at a point within 2'-0" of its junction with the water supply line. After sterilization is complete Contractor to provide cap at valve.
- F. Sterilization Procedure to be as follows:
 - 1. Flush pipe system by opening all outlets and letting water flow through the system until clear water flows from all outlets.
 - 2. Inject disinfecting agent to provide a minimum chlorine residual concentration of at least 50 parts per million (ppm) of free chlorine at each outlet.
 - 3. Provide sign at all outlets which reads "Water Sterilization in Progress – Do not operate". Remove signs at conclusion of test.
 - 4. Close all outlets and valves, including valve connecting to water supply line and 1" service valve. Retain treated water in pipe for a minimum of twenty-four hours. Should chlorine residual at pipe extremities be less than 50 PPM at this time, pipe shall be re-chlorinated. As an option, the water systems may be filled with a water-chlorine solution containing a minimum of 200 PPM of chlorine and allowed to stand for three hours.
 - 5. After chlorination, flush lines of chlorinated water and refill from domestic supply. Continue flushing until residual chlorine is less than or equal to 0.2 ppm, or a residual the same as that of the test water.
- G. Chemical and bacteriological tests shall be conducted by a state-certified laboratory and approved by the local authorities having jurisdiction.
- H. Submit written report to Health Department as required by State Regulations. Provide a copy of report to Architect prior to completion of project.
- I. The costs of sterilization and laboratory testing shall be paid for by the contractor.

3.10 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

END OF SECTION

SECTION 33 40 00

SITE DRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Storm Drain piping, fittings, structures.

B. RELATED SECTIONS

1. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.
2. Section 01 50 00, Construction Facilities and Temporary Controls.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 32 16 00, Site Concrete.
5. Section 33 00 00, Earthwork.

1.02 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.
- I. NFPA 13, 24 and 25, latest editions as adopted by 2022 CBC chapter 35 and 2022 CFC chapter 80.
- J. California State Health and Safety Code Section 116875, Lead Free Public Water Systems.
- K. California Plumbing Code, 2022 edition.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00.
- B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.
- C. Provide sieve analysis from accredited testing lab on pipe bedding material. Analysis shall have a current date not older than project contract signing date.
- D. Substitution: Provide all data of proposed material being submitted as a substitution. Provide comparison with specified product data and identify all differences. Failure to provide comparison will be reason for rejection.

1.04 QUALITY ASSURANCE

- A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the drawings to be salvaged and re-used.
 - 1. Sun damaged or discolored PVC pipe will be rejected.
- B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.
- C. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects or deficiencies discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the contractor.
- D. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction or incorrect grades will be the responsibility of the contractor.
- E. Per 2022 NFPA 13 provide Contractor's material and test certificate to the Owner, Architect, Project Inspector and Local Fire Authority.

1.05 FEES, PERMITS, AND UTILITY SERVICES

- A. Obtain and pay for permits and service charges required for installation of Work. Arrange for required inspections and secure written approvals from authorities having jurisdiction.
- B. Upon completion of work within right-of-way, provide copies of written final approval to the Architect.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Transport, store and handle in strict accord with the local jurisdiction.

- B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

1.07 PROJECT CONDITIONS

- A. Existing civil, mechanical and electrical improvements are shown on respective site plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, he is to immediately notify the Architect before continuing work.
- B. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1.08 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.09 PROTECTION

- A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside building area disturbed by operations.
- B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.
- C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.
- D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion or gullyng of sides of excavation.
- E. Surface Drainage: Provide for surface drainage during period of construction in manner to avoid creating nuisance to adjacent areas. The contractor shall make a reasonable effort on a daily basis to provide pumps and all equipment necessary to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.
- F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.
- G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust

control measures shall be in accordance with the local jurisdiction.

- H. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.

1.10 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

1.11 RECORD DRAWINGS

- A. Keep a daily record of all pipe placed in ground, verified by Project Inspector.
- B. Upon completion of this Contract, furnish one tracing showing all outside utility lines, piping, etc., installed under this Contract. Locate and dimension all work with reference to permanent landmarks.
- C. All symbols and designations used in preparing "RECORD" drawings shall match those used in Contract drawings.
- D. Properly identify on as-builts and provide dimensions for all stubs for future connections. Provide concrete markers 6" dia. 12" deep, flush with finish grade at the ends of all stubbed pipes.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pipe: Use one of the following, unless noted on the Drawings otherwise.
 - 1. Polyvinyl Chloride Pipe (PVC): SDR35 conforming to ASTM D3034 with elastomeric joints conforming to ASTM D3212. Sun damaged pipe will be rejected.
 - 2. High density polyethylene pipe (HDPE): The pipe shall be corrugated exterior/smooth interior pipe and water tight per ASTM D3212 with dual wall water tight gasket fittings.
- B. Perforated Pipe (for subdrains): Shall be ADS N12 pipe, 3 hole, ASTM F 405, AASHTO M 252; PVC ASTM D3034 SDR-35 storm drain pipe
- C. Manhole: Shall be as shown on the drawing details.
- D. Drop Inlet: Shall be as shown on the drawing details.
- E. Curb Inlet: Shall be as shown on the drawing details.
- F. Mortar: For pipe connections to concrete drainage structures, conform to ASTM C270 type N mortar. Place within one half hour after adding water.
- G. Crushed Rock: Imported washed crushed rock. Minimum 100% passing 3/4 inch sieve.

- H. Trench drain: Polycast, Polydrain or equal and as shown on drawings.
- I. Area Drains: Shall be as shown on the drawing details.
- J. Floor Drains: Shall be as shown on the drawing details.
- K. Clean-outs: Shall be as shown on the drawing details.
- L. Planter drains: Shall be as detailed on the drawing details.
- M. Filter Fabric: Mirafi 140N.

PART 3 - EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

- A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence.
- B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.
- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 INSTALLATION

- A. General: Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.
- B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.
- C. Excavation and Bedding:
 - 1. General: Trench straight and true to line and grade with bottom smooth and free of irregularities or rock points. Trench width in accordance with pipe manufacturer's recommendations and as per the drawings. Follow manufacturer's recommendations for use of each kind and type of pipe.
 - 2. Bedding: Provide bedding as detailed on plans for the full length of the pipe. Bedding shall have a minimum thickness beneath the pipe of 4" or 1/8 the outside diameter of the pipe, whichever is greater. Provide bell holes and depressions for pipe joints only of size required to properly make joint.
 - 3. If the trenches for the site drainage fall within areas to be lime treated, the piping shall be installed prior to any lime treatment operations.
 - a. If additional piping is added to previously lime treated areas, the contractor shall backfill the trench with class 2 aggregate base and compact to 95%.

D. Laying of Pipe:

1. General: Inspect pipe prior to placing. Set aside any defective or damaged material. Do not place pipe in water nor place pipe when trenches or weather are unsuitable. Lay pipe upgrade, true to line and grade.
2. Bell and Spigot Joints: Lubricate inside of bells and outside of spigots with soap solution or as recommended by manufacturer. Wedge joints tight. Bell of bell and spigot pipe to be pointed upgrade.
3. Pipe shall be bedded uniformly throughout its length.
4. Pipe elevation shall be within 0.02 feet of design elevation as shown on plans.
5. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the governing agency.

E. Backfilling:

1. General: Do not start backfill operations until required testing has been accomplished.
2. Trenches and Excavations: Backfill with material as detailed on plans, filling both sides of the pipe at the same time, carefully tamping to hold pipe in place without movement. Refer to Section 31 23 33 – TRENCHING AND BACKFILLING for fill above this layer.
3. Backfill in Areas Previously Lime or Cement Treated:
 - a. If trenching is necessary in areas that have been previously lime treated the contractor shall backfill the trench with class 2 aggregate base from the top of utility initial backfill up to subgrade in accordance with these specifications. **Lime treated soil may not be re-used once it has been compacted and cured. If re-excavated, it must be disposed of.** In Synthetic track and Synthetic Turf areas, following backfill to subgrade, a 13' wide bridging geogrid, Tensar BX 1100 or Tx140 shall be laid centered over trench on subgrade along entire length of the trench. Geogrid may be waived by the onsite geotechnical engineer based on actual soil conditions.

F. Grouting of Pipes: Grout pipes smooth and water tight at drop inlet, manholes, and curb inlets. Grout back side of hood at curb inlets all grouting shall be smooth and consistent.

G. Off Site Work: All work beyond the property lines shall be done in strict conformance with the requirements of the local agency.

H. Cutting and Patching: Remove and replace existing surface features per applicable specification section (i.e. asphaltic concrete or concrete paving) where pipe is installed in areas of existing improvements.

3.03 TOLERANCES

A. Storm Drain structure grates

1. In landscape and lawn areas $\pm 0.05'$.
2. In sidewalk and asphalt pavement $\pm 0.025'$.
3. In curb and gutter application $\pm 0.0125'$.

B. Cleanout Boxes and Lids

1. In landscape areas; 0.10 higher than surrounding finish grade, $\pm 0.05'$.

2. In sidewalks and asphalt pavement; Flush with surrounding finish grade, $\pm 0.025'$.

3.03 DEWATERING

- A. Contractor to provide trench dewatering as necessary, no matter what the source is, at no additional cost to the owner.
- B. If the previously excavated material from trenching is too wet to achieve trench backfill compaction the contractor shall make a reasonable effort to aerate and dry the material per section 31 00 00, 3.08, B

3.04 FLUSHING

- A. The Contractor shall thoroughly ball and flush the storm drain system to remove all dirt and debris. Discharge water to an approved location.

3.05 CLEANING

- A. Refer to Section 01 74 00.
- B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.
- C. Clean the dirt, rocks, and debris from all storm drain inlets, structures, and connecting pipes.

END OF SECTION