PROJECT MANUAL

Sonoma County SELPA

Portable Building

5860 Labath Avenue
Rohnert Park, CA 94928

Sonoma County Office of Education

5340 Skylane Blvd.
Santa Rosa, CA 95403

2194 Carmel Valley Rd
Del Mar, CA 92014
Phone: (619) 392-8622
Project No: 2022-009.00
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SECTION 024100
SITE DEMOLITION

PART 1 – GENERAL

1.1 INCLUSION OF OTHER CONTRACT DOCUMENTS
   A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE
   A. Section 310000, Earthwork.

1.3 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.

1.4 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.
1.5 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.

1.6 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.

D. Protect existing items which are not indicated to be altered.

1. 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 bench marks from damage or displacement.

E. Trees: Carefully protect existing trees that are to remain. Provide temporary irrigation as necessary to maintain health of trees.
F. 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.

G. 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.

H. 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.

I. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

J. 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

3.1 EXAMINATION

A. Examine conditions of work in place before beginning work; report defects.

B. Report existence of hazardous materials or unsafe structural conditions.

3.2 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 Owners 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.

3.3 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.

3.4 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. Pot-hole 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.

3.5 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.

3.6 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 310000.

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.


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.

3.7 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.

3.8 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 024100
SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture
design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS
   A. Material certificates.
   B. Material test reports.
   C. Floor surface flatness and levelness measurements.

1.4 QUALITY ASSURANCE
   A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that
      complies with ASTM C 94/C 94M requirements for production facilities and equipment.
      1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production
         Facilities."
   B. Testing Agency provided by District.
C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete,"
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. See Structural Drawings.

2.3 CONCRETE MATERIALS

A. See Structural Drawings.

2.4 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A Include manufacturer’s recommended adhesive or pressure-sensitive tape.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

2.5 RELATED MATERIALS

A. Expansion and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
2.6 CONCRETE MIXTURES

A. See Structural Drawings.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.
3.7 FINISHING FORMED SURFACES

A. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.-long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000
SECTION 09 91 00
PAINTING AND FINISHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.
B. Painting schedules, including painting of exposed surfaces, interior and exterior, except as otherwise specified or indicated.

1.2 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 Section 01 42 00 for definitions, acronyms, and abbreviations.
B. Unless otherwise noted, standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes as of the date of issue of this Project Manual
C. Referenced Standards:
   2. The Master Painters Institute, MPI Gloss and Sheen Levels.

1.3 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with sufficient documented experience.
B. Applicator: Company specializing in commercial painting and finishing with sufficient documented experience.
C. Gloss Levels: Per Master Painters Institute (MPI) gloss standards “MPI Gloss and Sheen Levels,” measured in accordance with ASTM D523.

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<th>SHEEN AT 85 DEGREES ASTM D523</th>
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<tr>
<td>G1</td>
<td>A traditional matte finish – flat.</td>
<td>5 units, maximum</td>
<td>and 10 units, maximum</td>
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<tr>
<td>G2</td>
<td>A high side sheet flat – “a velvet-like finish.”</td>
<td>10 units, maximum</td>
<td>And 10 – 35 units</td>
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<td>G4</td>
<td>A “satin-like” finish</td>
<td>10-25 units</td>
<td>and 35 units maximum</td>
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<td>A traditional semi-gloss.</td>
<td>35 - 70 units</td>
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<tr>
<td>G6</td>
<td>A traditional gloss.</td>
<td>70 - 85 units</td>
<td>-</td>
</tr>
<tr>
<td>G7</td>
<td>A high gloss.</td>
<td>More than 85 units</td>
<td>-</td>
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1.4 REGULATORY REQUIREMENTS

A. Conform to California Building Code for flame spread and smoke density requirements for finishes.
B. Furnish certification that all paint coatings furnished for the location of the project comply with the EPA clean air act for permissible levels of volatile organic content for architectural coatings applied in California as designated by California Air Resources Board (CARB), 2019 California Green Building Standards Code, and the San Joaquin Valley Air Pollution Control District (SJVAPCD).

1.5 SUBMITTALS

A. Provide product data on all finishing products.
B. Submit four brush-out samples 8 inches by 10 inches in size illustrating color and gloss level selected for each surface finishing product scheduled.
C. Field Sample: Furnish sample of actual paint colors selected on portion of building item to receive paint as directed by Architect, prior to beginning interior and exterior painting.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in manufacturer's original unopened, labeled containers; inspect to verify acceptance.
B. Store and protect products from abuse and contamination.
C. Container labeling is to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.
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.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees F for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior work and interior work, unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.8 EXTRA STOCK

A. Provide a new and unopened five-gallon container of each type, color and sheen to Owner.

B. Label each container with color, in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.1 PAINT SYSTEMS, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

2.2 SUSTAINABLE DESIGN REQUIREMENTS

A. VOC Content: Provide materials that comply with VOC limits set by Rule 4601 of the San Joaquin Valley Air Pollution Control District and the 2019 California Green Building Standards Code Table 5.504.4.3; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
   1. Flat Paints and Coatings: VOC content not more than 50 g/L.
   2. Primers, Sealers, and Undercoaters: VOC content not more than 100 g/L.
   3. Nonflat Paints and Coatings: VOC content not more than 100 g/L.
   4. Nonflat-high gloss Paints and Coatings: VOC content not more than 150 g/L.
   5. Stains: VOC content not more than 250 g/L.
   6. Anti-Corrosive and Anti-Rust Paints and Primers applied directly to Ferrous Metals: VOC content not more than 250 g/L.
   7. Zinc-Rich Primer applied to Galvanized and Ferrous Metals: VOC content not more than 340 g/L.
   8. Varnish: VOC content not more than 450 g/L.
B. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. 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).

2. Restricted Components: Paints and coatings shall not contain any of the following:
   a. Acrolein.
   b. Acrylonitrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzyl phthalate.
   f. Cadmium.
   g. Di (2-ethylhexyl) phthalate.
   h. Di-n-butyl phthalate.
   i. Di-n-octyl phthalate.
   j. 1, 2-dichlorobenzene.
   k. Diethyl phthalate.
   l. Dimethyl phthalate.
   m. Ethylbenzene.
   n. Formaldehyde.
   o. Hexavalent chromium.
   p. Isophorone.
   q. Lead.
   r. Mercury.
   s. Methyl ethyl ketone.
   t. Methyl isobutyl ketone.
   u. Methylene chloride.
   v. Naphthalene.
   w. Toluene (methylbenzene).
   x. 1,1,1-trichloroethane.
   y. Vinyl chloride.

2.3 ACCEPTABLE MANUFACTURERS – PAINT

A. Refer to Table at the end of this Section.
2.4 ACCEPTABLE MANUFACTURERS – PRIMER SEALERS

A. Refer to Table at the end of this Section.

2.5 ACCEPTABLE MANUFACTURERS – STAIN AND CLEAR FINISHES

A. Refer to Table at the end of this Section.

2.6 MATERIALS

A. All paint materials shall be provided from a single manufacturer unless noted otherwise in this Section.
B. Coatings: Ready mixed. Process pigments to a soft paste consistency capable of being readily and uniformly dispersed to a homogeneous coating.
C. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.
D. Accessory Materials: All other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
E. All Materials specified by brand name or manufacturer shall be delivered unopened at the job in their original containers.

2.7 FINISHES

A. Refer to schedule at end of Section for surface finish schedule.

PART 3 - EXECUTION

3.1 GENERAL

A. Storage: All materials used by the painting contractor shall be stored and mixed in a place designated by the Owner or the Architect. The storage place must be kept neat and clean at all times. All cloths, waste or other material that might constitute a fire hazard shall be placed in a suitable metal container or shall be removed from the site or destroyed at the end of each day's work.

3.2 INSPECTION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application to the Architect, Architect's representative or inspector in writing. The Architect will cause such defect to be remedied.
C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster; Gypsum Wallboard: 12 percent.
2. Concrete Masonry Units: 10 percent.
3. Interior Located Wood: 15 percent.

D. Beginning of application constitutes acceptance of the surfaces.

3.3 PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or painting.

B. Correct minor defects and clean surfaces that affect work of this Section.

C. Seal marks that may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.


F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer, unless otherwise recommended by finish coating system manufacturer.

G. Shop-Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces as recommended by primer manufacturer. Prime shop-primed steel items with steel primers specified in this Section.

H. Concrete, Stucco and Masonry: All dust and loose mortar shall be removed by sweeping or by brushing with a stiff fiber or wire brush.

1. Concrete and masonry surfaces that show signs of efflorescent shall be treated with a zinc sulfate wash (3lbs. per gallon of water), or by scrubbing affected areas with a solution of muriatic acid. Remove loose crystals and rinse with clear water. Allow to dry thoroughly before painting.
   a. All surfaces defects and all cracks more than 1/16 inch wide shall be filled with patching plaster or spackle according to package directions and textured to match adjacent areas.
   b. Form oils or separating agents that might impair the adhesion or the appearance of the specified finish shall be removed before any materials are applied.

2. Plaster work that has cured for less than two months and all other plaster areas that show the presence of excessive amounts of free alkali when tested with phenolphthalein or some other suitable means shall be treated with a zinc sulfate wash (3 lbs. per gallon of water) to neutralize the alkali and obtain the optimum of surface carbonation.
   a. All surface cracks greater than 1/32 inch wide, holes and other surface defects shall be repaired as recommended by the finish paint manufacturer's written instructions.
I. Interior Wood Items Scheduled to Receive Finish: Hand sandpaper and wipe off dust and grit prior to priming. Seal knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

1. At woodwork with transparent finish, nail holes, cracks or defects shall be filled with wood filler tinted to match color of stain.

3.4 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.
B. Repair damage to other surfaces caused by work of this Section.
C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.
D. Remove empty paint containers from site.

3.5 WORKMANSHIP

A. All work shall be performed by experienced mechanics in a skillful manner. All materials shall be evenly applied so as to be free from sags, crawls or other defects. Coats shall be of the proper consistency and well brushed out as to show the minimum brush marks, except varnish and enamel which shall be uniformly applied. Brushes shall be clean and in good condition. All areas with a transparent coat will be repainted at contractor’s expense.

B. All painting shall be by brush, except plaster and gypsum board which may be by spraying with back rolling. Underside of soffits, covered walks, acoustical panels and screens may be completed by spraying with back rolling.

C. No work shall be completed under conditions that are unsuitable for the production of good results. No painting shall be completed while plaster is curing, or while wood sawing, sanding or cleaning is in process. Coats shall be thoroughly dry before the succeeding coat is applied. Finishes shall be uniform as to sheen, shine, color and texture, except when glazing is required.

D. No exterior painting shall be done in rainy, damp, or frosty weather. No Interior painting or finishing shall be permitted until the building has been thoroughly dried out by artificial heat. A minimum temperature of 50 degrees Fahrenheit shall be maintained in areas where the application or drying of paint is occurring.

E. This contractor shall take into account that not less than the following percentages of total surfaces shall be painted in deep (dark) tones of color selected: (This includes colors requiring ultra-deep bases)

1. Walls: 25%
2. Ceilings: 25%
3. Doors and Door Frames: 100%
4. Sheet Metal: 50%
5. Exposed Steel: 100%

3.6 APPLICATION

A. Apply products in accordance with manufacturer's instructions.
   1. Paint mil thicknesses shall not be less than the minimums recommended by the paint manufacturers.
   2. No Paint, varnish or stain shall be reduced or applied in any way except as herein specifically called for, or recommended by the manufacturer.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. The number of coats called for in the Painting Schedules included in this specification are the minimum number required. Additional coats may be required to achieve the desired finish.

H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Prime back surfaces of interior and exterior woodwork with primer paint, type as recommended by manufacturer.

J. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.7 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint interior surfaces of air ducts and convector heating cabinets that are visible through grilles and louvers with one) coat of flat black paint, to limit of sight line. Paint dampers exposed behind grilles to match face panels. Paint all new interior and exterior exposed ductwork and ductwork supports. Paint all new conduit, pipes and conduit/pipe supports in exposed interior and exterior locations.

B. Reinstall electrical plates, hardware, light fixture trim, and fittings removed for surface preparation or painting.

C. Do not paint factory-finished mechanical and electrical equipment.

3.8 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 from site daily.

3.9 PAINTING SCHEDULE – EXTERIOR SURFACES:

A. Ferrous Metal
   1st coat – Acrylic Low Sheen Primer
   2nd and 3rd coats – 100 percent Acrylic Semi-Gloss

B. Ferrous Metal (Industrial)
   1st coat – Epoxy Primer
   2nd and 3rd coats – Aliphatic Urethane Gloss Enamel
   For use at exterior metal architectural features/exposed structure

C. Galvanized Metal (Handrail and Guardrail Assemblies only)
   1st coat – Etch Prep
   2nd coat – Epoxy Satin Primer
   3rd and 4th coats – High Dispersion Pure Acrylic Polymer

D. Galvanized Metal and Aluminum (Except Handrail and Guardrail Assemblies)
   1st coat – Etch Prep
   2nd coat – Acrylic Low Sheen Primer
   3rd and 4th coats – 100 percent Acrylic Semi-Gloss

E. Exposed Concrete and Cement Plaster System with Cementitious Finish Coat
   1st coat – Acrylic Flat Primer
   2nd and 3rd coats – Elastomeric Flat

F. Cement Plaster System with Acrylic Finish Coat
   1st coat – Acrylic Flat Primer
   2nd and 3rd coats – Elastomeric Flat

G. Wood
   1st coat – Acrylic Flat Primer
   2nd and 3rd coats – 100 percent Acrylic Flat

H. Wood
   1st coat – Acrylic Flat Primer
   2nd and 3rd coats – 100 percent Acrylic Semi-Gloss
3.10 PAINTING SCHEDULE – INTERIOR SURFACES:

A. Gypsum Board
   1st coat – PVA Primer Sealer
   Texture by Section 09 29 00 Contractor
   2nd coat – PVA Primer Sealer – Tint towards final color.
   3rd and 4th coats – 100 percent Acrylic Semi-Gloss

B. Wood (Opaque Finish)
   1st coat – Acrylic Flat Primer – Tint towards final color.
   2nd coat and 3rd coats – 100 percent Acrylic Semi-Gloss

C. Interior Ferrous Metal
   1st coat – Acrylic Low Sheen Primer – Tint towards final color.
   2nd coat and 3rd coats – 100 percent Acrylic Semi-Gloss Enamel
   Typical paint system at all hollow metal doors, pressed metal frames, and exposed steel structure.

D. Galvanized Metal, Zinc Alloy Metal and Aluminum
   1st coat – Etch Prep
   2nd coat – Acrylic Low Sheen Primer – Tint towards final color.
   2nd coat and 3rd coats – 100 percent Acrylic Semi-Gloss Enamel
# PAINTING SCHEDULE

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END OF SECTION 09 91 00
SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. The work included under this section consists of furnishing all products, materials, finishes, supplies, equipment, tools and transportation, and performing all labor and services necessary for, required in connection with, or properly incidental to furnishing and installing signage as described in this section of the specifications, shown on the accompanying drawings, or reasonably implied therefrom, except as hereinafter specifically excluded.

B. Work Summary:
   1. Create final production artwork and layouts for each sign face.
   2. Furnish materials and labor associated with fabricating and finishing all signs.
   3. Provide packaging and transportation of all signs to the project site.
   4. Furnish material and labor required for installation of signage.
   5. All code required signage shall be field inspected per CBC 11B-703.1.1.2

C. Alternates
   1. Provide separate pricing for alternate designs shown on sheet W3.4. These alternate designs substitute for signs with the same sign type designation shown on sheets W3.1-W3.3. Quantities and locations are the same.

1.2 SUBMITTALS

A. Color Samples: Submit three sets of 6"x6" samples of each color for approval. See design drawings for colors and materials.

B. Product Data Sheets. Supply product data sheets for all products used in the manufacture and installation of signage.

C. Contractor shall be responsible for the structural design of freestanding signs, internal illumination, and methods for fastening and installation.

D. Applicable Standards and Publications: Unless otherwise specified or shown, signage shall conform to the following standards and publications:

   E. ANSI A-117.1 and the Americans with Disabilities Act (ADA).
   G. California Building Code (CBC), 2019, Sections 11B-216 and 11B-701-703.
   H. California Grade 2 Braille shall be used whenever Braille symbols are specifically required. Refer to CBC Section 11B-703.
I. ANSI A-117.1 and the Americans with Disabilities Act (ADA).
L. California Grade 2 Braille shall be used whenever Braille symbols are specifically required. Refer to CBC Section 11B-703.
M. Contractor shall be responsible for the quality of materials and workmanship of any firm acting as the Contractor's subcontractor.
N. Welding, where required, shall be in accordance with procedures specified in American Welding Society Standards using procedures, materials, and equipment of the type required for the work.

1.3 GUARANTEE

A. At a minimum, the Contractor shall warrant that all work installed under this Contract is free of defect and will remain in good working order for a period of one year for all surface improvements and five years for all underground work. If warranties specified elsewhere in these documents are for a longer period of time than that specified in this section, the longer warranties shall apply.
B. Manufacturer's Standard Product Warranties:
   1. Plastic Elements: Manufacturer's warranty against yellowing, cracking, crazing, or other visible and performance defects for a period of 5 years from the date of installation.
   2. Paint Coating: Acrylic polyurethane coating manufacturer's 5-year warranty against defects in materials.

PART 2 - CODE REQUIRED SIGNAGE

2.1 TYPES OF SIGNS

A. Room Identification: Interior and exterior signs identifying permanent rooms and spaces shall comply with CBC Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5. Where pictograms are provided as designations of permanent rooms and spaces, the pictograms shall comply with CBC Section 11B-703.6 and shall have text descriptors complying with CBC Sections 11B-703.2 and 11B-703.5.
B. Egress Signage: Signs for means of egress shall comply with CBC Section 11B-216.4.
C. Directional & Informational: Signs that provide direction to or information about interior and exterior spaces and facilities of the site shall comply with CBC Section 11B-703.5.
D. Toilet Room Signage: Signage for toilet rooms shall comply with CBC 11B-216.8.
E. Assistive Listening Systems: Signage for assistive listening systems shall comply with CBC 11B-216.10.
2.2 RAISED CHARACTERS: Raised characters shall comply with CBC Section 11B-703.2 and shall be duplicated in Braille complying with CBC Section 11B-703.3. Raised characters shall be installed in accordance with CBC Section 11B-703.4.

2.3 BRAILLE. Braille shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4.

2.4 INSTALLATION HEIGH AND LOCATION. Signs with tactile characters shall comply with CBC Section 11B-703.4.

2.5 VISUAL CHARACTERS. Visual characters shall comply with CBC Section 11B-703.5.

2.6 PICTOGRAMS. Pictograms shall comply with CBC Section 11B-703.6.

2.7 SYMBOLS OF ACCESSIBILITY. Symbols of accessibility shall comply with CBC Section 11B-703.7.

2.8 BACKGROUNDS: All sign backgrounds to have a non-glare finish.

PART 3 - PRODUCTS

3.1 MATERIALS

A. Acrylic Sheet. Cast methyl methacrylate monomer plastic conforming to ASTM D788, Sign Grade; “Plexiglas SQ” by Altuglas or equal, unless otherwise recommended by fabricator. Sizes and thicknesses as shown.

B. Silicone adhesive to be Dow Corning or approved equal, clear unless otherwise specified.

C. Adhesive tapes to be 3M or approved equal.

D. Paint products to be low VOC Matthews Acrylic Polyurethane or approved equal in colors specified. All finishes to be non-glare. Provide primer as recommended by coating manufacturer for each type of substrate.

E. Screen-printing enamel to be Nazdar or approved equal.

F. Engraving substrate to be Rowmark or approved equal. www.rowmark.com

G. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

H. Vinyl opaque film with pressure-sensitive adhesive backing, suitable for exterior applications, to be 3M or approved equal.

I. Sealant: As required to prevent light and water leakage. No exposed sealant shall be allowed except as indicated on the reviewed shop drawings.

J. LED lighting components to be Bitro Group or approved equal. Light color temp to be warm white, 2,700° K to 3,000° K.
PART 4 - EXECUTION

4.1 GENERAL

A. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary flanges, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.

B. Shop fabricate so far as practicable. Joints shall be fastened flush to conceal reinforcement or welded where thickness or section permits.

C. Contact surfaces of connected members must be assembled so joints will be tight and practically unnoticeable, with minimal use of filling compound.

D. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces to be smooth flat and without oil-canning, free of rack and twist. Restore texture to filed or cut areas.

E. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.

F. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.

G. Form joints exposed to weather to exclude water.

H. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints shall be tightly mitered to give appearance of solid material.

I. All painted surfaces shall be properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface shall be smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.

J. Movable parts, including hardware, are be cleaned and adjusted to operate as designed without binding of deformation of members. Doors and covers shall be centered in openings or frames. All contact surfaces fit tight and even without forcing or warping components.

K. All fasteners to be non-corrosive.

L. Security head screw to be used for all fasteners. Contractor to coordinate type of security screws used with campus facilities department.

4.2 CUTTING & FINISHING

A. All materials shall be cut with proper equipment using sharp blades. Shapes shall have square corners, straight edges and shall be sized as shown in the design drawings. Blade/cutter marks and scratches will not be accepted.

B. Materials shall be prepared and primed according to product manufacturer’s instructions before painting.

C. Finishes shall be applied according to product manufacturer's instructions, then properly cured and protected after application.
4.3 APPLICATION OF GRAPHICS

A. All graphics shall be cut, etched and/or printed to comply with the specified typeface and graphic shapes. Graphics and type shall be clean and crisp without deformation of characters, ticks, gaps or irregularities.

B. Finished surfaces shall be protected from damage during application of graphics.

4.4 PACKAGING

A. Completed signs shall be packed for shipment to the project site to protect from damage.

B. Pre-assemble items in 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 re-assembly and coordinated installation.

PART 5 - INSTALLATION

5.1 GENERAL

A. Protect products against damage during field handling and installation. Protect adjacent existing and newly placed construction, landscaping and surrounding wall and/or building finishes as necessary to prevent damage during installation. Paint and touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface.

B. All exterior signs to be staked by contractor for owner’s approval prior to sign installation or excavation.

C. Contractor will be responsible for verifying that, at each sign location, there are no utility lines that will be affected by installation of signs. Any damage during installation of signs to utilities will be the sole responsibility of the Contractor to correct and repair.

D. Furnish inserts and anchoring devices which must be set in concrete or other material for installation of signs. Provide setting drawings, templates, instructions and directions for installation of anchorage devices, which may involve other trades.

E. Mount signs in proper alignment, level and plumb. When exact position, angle, height or location is in doubt, contact Designer for clarification.

F. Remove or correct signs or installation work Owner determines as unsafe or as an unsafe condition.

5.2 CLEANING & ADJUSTING

A. Return items that cannot be refinished in the field to the shop. Make required alterations and refinish entire unit or provide new units.

B. Verify gaskets and flanges interface properly to provide a lightproof installation at monument sign.
C. After installation, clean soiled sign surfaces according to manufacturer's instructions. Protect from damage until acceptance by University.

D. At completion of sign installation, clean exposed sign surfaces. Clean and repair any adjoining surfaces and landscaping that became soiled or damaged as a result of installation of signs.

5.3 PUNCHLIST & PROJECT CLOSEOUT

A. Sign contractor shall review all installed work with the Client or Client's representative and make all required punchlist corrections. Once complete, the sign contractor shall back-check all punchlist items and receive Client's final approval of installation.

5.4 RECORD DOCUMENTS

A. As-Built Drawings

B. The Contractor shall submit to the University's Representative, 10 calendar days after Final Completion, fully updated As-built Drawings and Shop Drawings for review.

C. The As-Built Drawings and Shop Drawings shall be in PDF format. Email is acceptable.

END OF SECTION 10 14 00
SECTION 26 05 34
CONDUIT

PART 1 - GENERAL
1.1 SUMMARY
A. This section describes requirements for conduit raceways.

1.2 RELATED WORK
A. Section 26 0100: General Requirements for Electrical Work.
B. Section 26 0526: Grounding and Bonding.

1.3 REFERENCE STANDARDS
A. American National Standards Institute (ANSI):
   1. C80.1 Specification for Rigid Steel Conduit, Zinc Coated
   2. C80.3 Specification for Electrical Metallic Tubing, Zinc Coated
B. National Electrical Manufacturers Association (NEMA):
   1. TC 2 Electrical Plastic Tubing (EPT), Conduit (EPC-40 and EPC-80) and Fittings
C. Underwriters Laboratories, Inc. (UL):
   1. 1242 Intermediate Metal Conduit
D. Federal Specifications:
   1. WW-C-581E Conduit, Metal Electrical Conduit. Steel, Zinc Coated

1.4 SUBMITTALS
A. Procedure: Submit under provisions of Section 01 3000 - Administrative Requirements and Section 01 6000 - Product Requirements.
B. Provide submittals for items listed documenting compliance with specification requirements.
   1. Product Data:
   2. Electrical Materials: Manufacturer’s current published catalog sheets.

PART 2 - PRODUCTS
2.1 RACEWAYS
A. Rigid Steel Conduit:
   1. ANSI C80.1, minimum size 3/4 inch.
   2. Threaded fittings, galvanized.
   3. Locknuts, 3/4 inch to 1-1/2 inch, heavy nut steel.
   4. Locknuts, 1-1/2 inch and larger, malleable iron.
   5. Insulated bushings, malleable iron, plastic or nylon insert, OZ "IBC" series, Efcor "56" series, Appleton "GIB" series or equal.
   6. Three-piece conduit couplings, malleable iron, T & B "Erickson", Appleton "EC" series, OZ "4" series, or equal.
B. Intermediate Metal Conduit (IMC):
   2. Fittings: As specified for rigid steel conduit.

C. Electrical Metallic Tubing (EMT):
   1. Galvanized rolled steel ANSI C80.3.
   2. Fittings to 2 inch, rain-tight compression gland, steel, plated with zinc or cadmium, for wet locations and setscrew steel for dry locations.
   3. Couplings, to 2 inch:
      a. Compression type: OZ "6050S" series, T & B "5120" series, Efcor "760" series, or equal.
      b. Setscrew type: OZ "5050S" series, Steel City "TK121" series, Efcor "730" series, or equal.
   4. Connectors, insulated throat:
      a. Compression type: OZ "7050 ST" series, T & B "5123" series, Efcor "750B" Series, or equal.
      b. Setscrew type: OZ "4050 ST" series, Steel City "TC721" series, Efcor "720B" Series, or equal.
   5. Couplings, 2-1/2 inch to 4 inch, set-screw, four screw, steel plated with zinc or cadmium, OZ "5250S" series, T & B "5042" series, Efcor "736" series, or equal.
   6. Connectors, 2-1/2 inch to 4 inch, insulated throat, set-screw, two screw, plated with zinc or cadmium, Appleton "TW250 SI" series, Efcor "726B" series, or equal.
   7. Adapter, EMT to rigid steel, zinc or cadmium plated malleable iron, OZ, T & B, Efcor, or equal.
   8. Maximum size, 2 inch, except for Telephone, 4 inch.

D. Flexible Metal Conduit:
   1. Fabricate from galvanized steel strip, minimum size 1/2 inch.
   2. Connectors, T & B "Tite Bite", with insulated throat, or equal.
   3. Length, no greater than 6 feet. Allow slack for movement of connected equipment.

E. Liquid-tight Flexible Metal Conduit:
   1. Fabricate from galvanized steel strip, jacketed with PVC, minimum size 1/2 inch.
   2. Straight connectors, cadmium plated steel or malleable iron, insulated throat and neoprene sealing ring, OZ "4Q-IT" series, T & B "5330" series, Efcor "11-B" series, or equal.
   3. Angle connectors, cadmium plated steel or malleable iron, insulated throat and neoprene sealing ring, OZ, T & B, Efcor, or equal, comparable to straight connectors.
   4. Hardware, cadmium plated steel.
   5. Length, no greater than 6 feet. Allow slack for movement of connected equipment.

F. PVC Conduit:
   1. Schedule 40, NEMA TC2, Type II underground installation.
      a. Minimum size, 1 inch.
      b. Elbows, Schedule 40, encased in concrete for sizes 2-inch and larger.
      c. Extensions above grade, rigid steel (exposed), EMT (concealed indoors).
      d. Adapters, PVC to rigid steel, threaded plastic.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Conduit Support:
   1. Secure and support conduits in accordance with CEC and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Connections and Terminations:
   1. Use suitable adapters where required to transition from one type of conduit to another.
   2. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
   3. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

E. Penetrations:
   1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
   2. Make penetrations perpendicular to surfaces unless otherwise indicated.
   3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
   4. Conceal bends for conduit risers emerging above ground.
   5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
   6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
   8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

F. Conduit Movement Provisions: Where conduits are subject to thermal expansion, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. Where conduits are subject to seismic movement, provide 6 feet max. flex conduit with grounding fittings on each end bonded with #6 green wire. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection (seismic expansion joint).

G. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

H. Provide grounding and bonding in accordance with Section 26 0526.
I. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with CEC.

3.2 ABOVE GROUND RACEWAY SYSTEMS

A. Install all wiring in raceways. Install raceway systems, including conduits, hangers and support channels parallel or perpendicular to structural members in accordance with Section 260529 Hangers and 260502 Support. Coordinate location of raceway systems with other Divisions prior to commencing installation.

B. Rigid Steel Conduit: Suitable for use in all locations.

C. Intermediate Metal Conduit: As specified for rigid steel.

D. Electrical Metallic Tubing: Suitable for use in concealed dry locations, not in concrete, masonry, or underground, and suitable exposed, minimum 8 feet above finished floor.

E. Flexible Metal Conduit: Suitable for connection of recessed lighting fixtures, motors or other devices requiring flexible connections in dry locations.

F. Liquid-Tight Flexible Metal Conduit: Suitable for connection of motors and equipment in damp or wet locations.

G. Conduit Supports:
   1. Support all conduits at intervals per Chapter 3 of the CEC for the selected raceway type (not to exceed 10-feet).
   2. Support individual conduits with conduit hangers or clamp back and nest back, if required for entrance into the equipment.
   3. Support multiple conduits, 2 or more in parallel, with framing channel and pipe clamps.
   4. Spring steel fasteners may be used to fasten electrical metallic tubing to individual hanger wires, minimum #12 AWG, specifically used for hanging conduit, nothing else.

H. Conduit Bends:
   1. Provide no more than (3) 90-degree conduit bends or the equivalent number of smaller radius bends in any conduit run between boxes or equipment.
   2. Length of run: 400-feet maximum less 100-feet for each equivalent 90 degree bend.
   3. Fabricate bends and offsets with a hickey or conduit bender designed specifically for use with the type of conduit to be bent, or use factory made bend.
   4. Radius of Bends: Conduits 2" inside diameter or less the inside bend radius shall be at least 6 times the diameter. Conduits greater than 2" diameter the inside bend radius shall be at least 10 times the conduit diameter.

I. Cap conduits during construction to prevent entrance of foreign material.

J. Provide conduit-sealing bushings at conduit penetrations through exterior walls to seal against fluid and gas pressure around the conduit.

K. Fit all conduits that enter the enclosure of a switchboard, distribution panel, or motor control center with an insulated grounding bushing.

L. Install pull ropes in all empty conduits, #12 AWG in conduits 1 inch and smaller and 3/16 inch polypropylene rope in conduits 1-1/4 inch and larger.

3.3 UNDERGROUND RACEWAY SYSTEMS

A. Install all wiring in raceways. Coordinate location of raceway systems with other Divisions prior to commencing installation. Provide excavation, clearances from other utilities, encasing, trenching, boring, backfill, compaction, patching, per Division 31 Site Preparation. Provide conduits per drawings.
B. EXCAVATING AND BACKFILLING

1. Excavate and backfill as required for installation of electrical work. Maintain all warning signs, barricades, flares and lanterns as required by the Safety Orders and local ordinances.

2. Excavation: Dig trenches straight and true to line and grade, with bottom clear of any rock points. Support conduit for entire length on undisturbed original earth. Backfill: All backfill material shall be local material free of rubble, rubbish or vegetation. Trenches shall be backfilled and compacted to 90% of maximum dry density at optimum moisture content in layers not to exceed 6" when compacted.

3. Minimum Coverage (depth) - Per CEC Table 300.5

4. Area of Influence- Do not install conduits parallel to building footings in the area of influence. See structural drawings and specifications for the area of influence and the methods that conduits can cross a footing.

5. Drain Slope- Underground conduit shall be installed such that a .125" per foot min. slope exists at all points of the run to allow drainage and prevent the accumulation of water. Provide a drain slope of greater than .125" per foot when extending conduit away from a building.

6. Provide underground warning tape along entire conduit length.

C. CUTTING AND PATCHING

1. Provide necessary cutting and patching required to accomplish the work of Division underground 26. Restore all surfaces, roadways, sod, walks, curbs, walls, existing underground installation, etc., cut by installations to original condition in an acceptable manner.

D. Conduit Bends:

1. Provide no more than (3) 90-degree conduit bends or the equivalent number of smaller radius bends in any conduit run between boxes or equipment.

2. Length of run: 400-feet maximum less 100-feet for each equivalent 90 degree bend.

3. Fabricate bends and offsets with a hickey or conduit bender designed specifically for use with the type of conduit to be bent, or use factory made bend.

4. Radius of Bends: Conduits 2" inside diameter or less the inside bend radius shall be at least 6 times the diameter. Conduits greater than 2" diameter the inside bend radius shall be at least 10 times the conduit diameter.

E. Rigid Steel Conduit: Suitable for use in all locations. Where used underground, wrap with no less than 2 layers of half-lapped 10 mil vinyl pipe wrapping tape, Manville, Minnesota Mining

F. PVC Conduit: Suitable for use underground, with a minimum of 18 inches of cover. Also suitable for use in concrete slabs (for healthcare facilities, use Schedule 80 PVC ). Fabricate field bends with an approved thermal bender and jig. Maintain separation between conduits using plastic spacers specifically designed for the purpose.

G. Provide conduit-sealing bushings at conduit penetrations through exterior walls to seal against fluid and gas pressure around the conduit. Ducts shall be sealed to resist liquid and gas infiltration at all maintenance holes and building entrances.

H. Install pull ropes in all empty conduits, #12 AWG in conduits 1 inch and smaller and 3/16 inch polypropylene rope in conduits 1-1/4 inch and larger.

I. Fit PVC conduits that enter pullboxes and junction boxes with belled ends.

END OF SECTION
SECTION 26 05 37
BOXES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS
   A. Section 26 2726 - Wiring Devices:
      1. Wall plates.

1.2 REFERENCE STANDARDS
   A. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and
      Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).
   B. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical
      Manufacturers Association; 2008 (Revised 2010) (ANSI/NEMA OS 1).
   C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical
      Manufacturers Association; 2008.
   D. CEC - California Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including
      All Applicable Amendments and Supplements.
   E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition,
      Including All Revisions.
   F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including
      All Revisions.

1.3 SUMMARY
   A. Provide electrical materials, installation and testing for the interior improvements in Relocatable Building
      Houston Middle School.

1.4 DESCRIPTION
   A. This section describes requirements for outlet boxes.

1.5 RELATED WORK
   A. Section 26 0100: General Requirements for Electrical Work.

1.6 REFERENCE STANDARDS
   A. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and
      Cable; National Electrical Manufacturers Association; 2007.
   B. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical
      Manufacturers Association; 2008.
   C. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; National Electrical
      Manufacturers Association; 2008.
   D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical
      Manufacturers Association; 2008.
1.7 SUBMITTALS
A. Procedure: Submit under provisions of Section 01 3000 - Administrative Requirements and Section 01 6000 - Product Requirements.
B. Provide submittals for items listed documenting compliance with specification requirements.
C. Product Data:
   1. Electrical Materials: Manufacturer’s current published catalog sheets.

PART 2 - PRODUCTS
2.1 BOXES
A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by CEC and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
   4. Where box size is not indicated, size to comply with CEC but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use “through-wall” boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   12. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
   1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

D. Cast Boxes: NEMA FB 1, Type FD, cast ferroloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.2 OUTLET BOXES
A. Construction: Deep drawn or fabricated interlocked flat pieces with welded tabs, electro-galvanized sheet steel with electro-galvanized hardware. Do not use sectional boxes.
B. Size: To accommodate the required number and sizes of conduits, wires, splices and devices but not smaller than the size indicated or specified.
C. Plaster Ring: Provide flush with wall or ceiling finish, except where otherwise indicated or specified.
D. Device Boxes: For single switches and receptacles, provide boxes not less than 4 inches square by 1-1/2 inches deep. For 2 devices, provide boxes not less than 4-11/16 inches square by 1-1/2 inches deep.
E. Telecommunications Boxes: No less than 4-11/16 inches square by 2 inches deep.
F. Special Mounting: In cabinets, tile, concrete block, brick, stone, wood or similar material, provide rectangular boxes with square corners and straight sides. For single devices, provide boxes 4 inches high by 2-1/2 inches wide by 3-3/8 inches deep. For 2 or more devices, provide multi-gang, non-sectional box with tile or masonry ring.
G. Attach device boxes with adjustable bar type hangers screw fastened to two stud/ceiling joists on both sides of box.

2.3 PULL AND JUNCTION BOXES
A. General: For all pull and junction boxes over 300 cubic inches, provide code gauge, sheet steel boxes which meet NEMA 1 standards for panelboard and terminal cabinet box construction, with screw type covers.
B. Ground Lug: Weld, before finish is applied, a grounding pad drilled for two bolted grounding lugs or two ground studs on the box interior.
C. Finish: Apply rust inhibiting prime coat and 2 coats of baked enamel, standard factory gray.
D. Hardware: Cadmium plated steel screws.

PART 3 - EXECUTION
3.1 BOXES AND CABINETS
A. Place outlet boxes in a location as close to that shown on the plans as possible. Coordinate location of boxes with other Divisions.
B. Install wall mounted outlet boxes so that the distance from the centerline of the box to finished floor is as listed or indicated:
   1. Receptacles, + 1 foot-6 inches
   2. Telephone, + 1 foot-6 inches
   3. Data, + 1 foot-6 inches
   4. Switches, + 4 feet-0 inches
C. Install junction boxes with covers in concealed areas accessible after installation. Do not install junction boxes flush with finish walls or ceilings unless specifically approved by the Engineer.
D. Attach surface boxes with:
1. Steel or malleable iron expansion anchors in concrete or solid masonry.
2. Wood screws in wood.
3. Toggle bolts in hollow walls or masonry.
4. Machine screws, bolts or welded studs in steel.

E. Attach flush boxes with adjustable bar type hangers screw fastened to studs on both sides of the box.

END OF SECTION
SECTION 26 05 53
IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.2 REFERENCE STANDARDS


1.3 DESCRIPTION

A. Extent of electrical identification work is as outlined by this specification.
B. Types of electrical identification work specified in this section include the following:
   1. Buried cable warnings.
   2. Electrical power, control and communication conductors.
   3. Operational instructions and warnings.
   4. Danger signs.
   5. Equipment/system identification signs.

1.4 RELATED REQUIREMENTS

A. Section 26 0100: General Requirements for Electrical Work.

1.5 QUALITY ASSURANCE

A. California Electrical Code (CEC) Compliance: Comply with CEC as applicable to installation of identifying labels and markers for wiring and equipment.
B. Underwriters Laboratories, Inc. (UL) Compliance: Comply with applicable requirements of UL Standard 969, "Marking and Labeling Systems", pertaining to electrical identification systems.
D. National Electrical Manufacturer's Association (NEMA) Compliance: Comply with applicable requirements of NEMA Standard No's WC-1 and WC-2 pertaining to identification of power and control conductors.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical identification materials and products.
B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

PART 2 - PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Panelboards:
      1) Identify ampere rating.
      2) Identify voltage and phase.
      3) Identify power source and circuit number. Include location when not within sight of equipment.
      4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
      5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
   c. Enclosed switches, circuit breakers, and motor controllers:
      1) Identify voltage and phase.
      2) Identify power source and circuit number. Include location when not within sight of equipment.
      3) Identify load(s) served. Include location when not within sight of equipment.
   d. Enclosed Contactors:
      1) Identify ampere rating.
      2) Identify voltage and phase.
      3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
      4) Identify coil voltage.
      5) Identify load(s) and associated circuits controlled. Include location.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
   b. Use identification nameplate at each piece of service equipment to identify the available fault current and the date calculations were performed.

3. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

5. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
   a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches (76 mm) wide, painted in accordance with Section 09 9123 and 09 9113.

6. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches (89 mm by 127 mm).
b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

7. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Identification for Communications Conductors and Cables: Comply with Section 27 1005.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C. Identification for Raceways:
1. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet (6.1 m).
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
      1) Color Code:
         (a) Fire Alarm System: Red.
      2) Field-Painting: Comply with Section 09 9123 and 09 9113.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.

D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.
      1) Fire Alarm System: Red.

2.2 IDENTIFICATION NAMEPLATES AND LABELS
A. Identification Nameplates:
1. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
2. Legend:
   a. System designation where applicable:
      1) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch (25 mm).
   b. Equipment Designation: 1/2 inch (13 mm).
5. Color:
   b. Fire Alarm System: White text on red background.

D. Format for Control Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

E. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Red text on white background.

2.3 WIRE AND CABLE MARKERS
A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch (3 mm).
F. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:
   1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
   3. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

D. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:

E. Color: Black text on orange background unless otherwise indicated.

2.5 NOT USED

2.6 FLOOR MARKING TAPE

A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches (76 mm) wide, with alternating black and white stripes.

2.7 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

2.8 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):
   1. Almetek,
   2. Brady, W.H. Company,
   3. Calipico Inc.,
   4. Cole-Flex Corporation,
   5. Direct Safety Company,
   6. George-Ingraham Corporation,
   7. Griffolyn Company,
8. Ideal Industries, Inc.,
9. LEM Products, Inc.,
10. Markal Company,
11. National Band and Tag Company,
12. Panduit Corporation,
13. Seton Name Plate Company,
14. Tesa Corporation,
15. Or equal.

2.9 ELECTRICAL IDENTIFICATION MATERIALS

A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, provide single selection for each application.

B. Color-Coded Plastic Tape:
   1. Provide manufacturer's standard self-adhesive vinyl tape not less than 3 mils thick by 1-1/2 inches wide.
      a. Colors: Unless otherwise indicated or required by governing regulations, provide orange tape.

C. Underground-Type Plastic Line Marker:
   1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.

D. Cable/Conductor Identification Bands:
   1. Provide manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers of wrap-around type, either pre-numbered plastic coated type, or write-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification.

E. Plasticized Tags:
   1. Manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matte finish suitable for writing, approximately 3-1/4 x 5-5/8 inches, with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.

F. Self-Adhesive Plastic Signs:
   1. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.

G. Colors: Unless otherwise indicated, or required by governing regulations, provide white signs with black lettering.

H. Baked Enamel Danger Signs:
   1. General: Provide manufacturer's standard DANGER signs of baked enamel finish on 20-gauge steel; of standard red, black and white graphics; 14 x 10 inches size except where 10 x 7 inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.

I. Engraved Plastic-Laminate Signs:
   1. Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated,
black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2. Thickness: 1/8 inch, except as otherwise indicated.

3. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.10 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of CEC and OSHA.

2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification:

1. Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated use white as coded color for conduit.

C. Box Identification:

1. After completion, using an indelible wide tip marker, indicate on the cover of each junction and pull box the designation of the circuits contained therein, i.e., A-1, 3, 5. Use a black marker for normal power circuits a red marker for critical circuits, an orange marker for life safety circuits, and a green marker for equipment circuits.

2. All junction and pull boxes for wiring systems above 600V shall be identified with high voltage warning labels installed every 20 linear feet in accordance with OSHA standards. All boxes shall also be painted red, see Section 09900 of the specifications.

3. All junction and pull boxes for the fire alarm system shall be painted red. All raceway for the fire alarm system shall be labeled “Fire Alarm” in red letters on intervals not to exceed ten feet.

D. Underground Cable Identification:

1. During back-filling/top-soiling of each exterior underground electrical, signal or communication conduits, install continuous underground-type plastic line marker, located directly over buried line at 6 to 8 inches below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16 inches, install a single line marker.

2. Install line marker for every buried conduit.

E. Cable/Conductor Identification:

1. Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project’s
electrical work. Refer to Section 16100 - Basic Materials and Methods of these specifications for color coding requirements.

F. Operational Identification and Warnings:

1. Wherever directed by the Owner’s Representative, to ensure safe and efficient operation and maintenance of electrical systems, including prevention of misuse of electrical facilities equipment by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes. Request a meeting with the Owner’s Representative prior to substantial completion to coordinate warning requirements.

G. Danger Signs:

1. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations identified by the Owner’s Representative as constituting similar dangers for persons in or about project. Request a meeting with the Owner’s Representative prior to substantial completion to coordinate danger sign requirements.
   
a. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.
   
b. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

H. Equipment/System Identification:

1. Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2 inch high lettering, on 1-1/2 inch high sign (2 inch high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
   
a. Electrical cabinets and enclosures.
   
b. Access panel/doors to electrical facilities.
   
c. Transformers.
   
d. Fire alarm control panel, battery cabinets, voice alarm system cabinets, and transponders.

2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate. Identification of flush mounted cabinets and panelboards shall be on the inside of the device.

3. Panelboards, individually mounted circuit breakers, and each breaker in the switchboards, secondary unit substations, and distribution panels shall be identified with an engraved plastic laminate sign. Plastic nameplates shall be multicolored laminated plastic with faceplate and core as scheduled. Lettering shall be engraved minimum 1/4 inch high letters.
   
a. 208/120 volt normal power equipment shall be identified with green faceplate with white core.
   
b. 208/120 volt equipment branch power equipment shall be identified with blue faceplate with white core.
   
c. Equipment identification is to indicate the following:
      1) Equipment ID abbreviation.
      2) Voltage, phase, wires and frequency.
3) Emergency or other system.
4) Power source origination.
5) Example:
   (a) Panel GLSH1
   (b) 208/120V, 3 phase, 4 wire
   (c) Fed by GLSD1

d. Submit complete schedule with the shop drawings listing all nameplates and information contained thereon.

END OF SECTION
SECTION 26 08 01

ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work required under this section of the specifications consists of the electrical acceptance testing and inspections for all electrical systems and equipment installed or affected by this project. The Contractor shall prepare and submit to the Engineer for review and approval acceptance test procedures and inspection forms in accordance with this specification. A complete functional acceptance test shall be performed on all electrical systems and equipment to prove they perform as intended under all modes of operation. Testing specified in other sections is in addition to testing specified herein. Also the testing will demonstrate the electrical system and equipment operation to the Owner. All labor, materials, rentals, permits and testing equipment or other which is required shall be provided by the Contractor.

1.2 GENERAL

A. The Contractor shall prepare and submit to the Engineer for review and approval acceptance test procedures and inspection forms in accordance with this specification. Testing shall be performed by the Contractor, the manufacturer's representative, and/or an International Electrical Testing Association (NETA) testing company depending on the type of equipment or system being tested as follows:

1. CONTRACTOR
   a. Cables, Low-Voltage, 600-Volt Maximum
   b. Switches and Circuit Breakers, Air, Low-Voltage
   c. Fiber Optic Cable
   d. Clock System
   f. Telecommunications System
   g. Grounding System
   h. Low Voltage (600 VAC maximum) Power Distribution System
   i. Instrument and Control System

2. MANUFACTURER'S REPRESENTATIVE
   a. Fire Alarm System

3. NETA
   a. NOT USED
   b. Ground Fault Protection System
   c. Circuit Breakers

B. The Contractor shall prepare the test procedures and inspection forms and perform the specified testing and inspections, for the assigned equipment and systems above, as applicable to the equipment and systems installed or affected by the project. If the Contractor (including sub contractors) does not have the ability or qualifications to conduct the required tests then the Contractor will sub contract with a testing organization who does.

C. The Contractor shall engage in and pay for the services of the Manufacturer's Representative approved testing organizations to provide testing and inspection of the applicable electrical equipment and systems as listed above and specified in this section. The testing organizations may be an independent division or authorized representative of the manufacturer of the assembled products being tested. The Manufacturer's Representative will conduct startup testing and will be part of integrated system testing. If
an outside testing organization is approved, a representative of the manufacturer shall be under contract by the testing company. The representative shall be present during all testing to insure that the testing is performed properly and that any deficiencies discovered are promptly corrected. The Manufacturer's Representative will assist in the preparation and performance of other test procedures and inspections such as integrated system testing (e.g., loss of power/ generator/ats/ups/annunciator integrated system test)

D. The Contractor shall engage in and pay for the services of a NETA Accredited Testing Company to provide testing and inspection applicable electrical equipment and systems as listed above and specified in this section. Also, the NETA testing contractor will conduct integrated system testing or other testing as required. NETA testing will be conducted per the current Standard for NETA Acceptance Testing Specification including test report preparation and submittals. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment. Technicians shall be certified in accordance with the current ANSI/NETA ETT, Standard for Certification of Electrical Testing Personnel. Each on-site crew leader shall hold a current certification, Level III or higher, in electrical testing. The testing organization shall provide the following: A written record of all tests and a final report; All field technical services, tooling, equipment, instrumentation, and technical supervision to perform such tests and inspections; Specific power requirements for test equipment; Notification to the owner's representative prior to commencement of any testing; A written record of all tests and a final report and a timely notification of any system, material, or workmanship that is found deficient based on the results of the acceptance tests. The NETA contractor will assist in the preparation and performance of other test procedures and inspections such as an acceptance testing of the integrated system (e.g., loss of power/generator/ATS/UPS/annunciator integrated system test)

E. Submit all test reports to the Owners Representative at least two weeks prior to the project final inspection for review.

1.3 SAFETY AND PRECAUTIONS
A. All parties involved must be cognizant of industry-standard safety procedures. This document does not contain any procedures including specific safety procedures. It is recognized that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be qualified and capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved.

B. Safety practices shall include, but are not limited to, the following requirements:
1. All applicable provisions of the Occupational Safety and Health Act, particularly OSHA 29 CFR Part 1910 and 29 CFR Part 1926 including OSHA lockout procedures.
2. ANSI/NFPA 70E, Standard for Electrical Safety in the Workplace.
3. Applicable state and local safety operating procedures.
4. Owner's safety practices.
5. A safety lead person shall be identified prior to the commencement of work.
6. A safety briefing shall be conducted prior to the commencement of work.
7. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required to be ungrounded or energized for certain tests.
8. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety.

1.4 QUALITY ASSURANCE
A. The testing and inspection shall comply with all applicable sections of the following codes and standards:
1. American National Standards Institute - ANSI
3. Association of Edison Illuminating Companies - AEIC
4. Institute of Electrical and Electronics Engineers - IEEE
5. Insulated Power Cable Engineers Association - IPCEA
7. California Electrical Code - CEC
8. National Electrical Manufacturers Association - NEMA
10. State and Local Codes and Ordinances

B. The inspection and testing shall comply with the project plans and specifications as well as with the manufacturer's drawings, instruction manuals, and other applicable data for the apparatus tested.

C. Review and Approval- All test reports, deficiencies and corrections, test results, shall be reviewed by the Engineer of Record.

1.5 DIVISION OF RESPONSIBILITY

A. Perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

B. Supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.

C. Notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. Supply a complete set of electrical plans, specifications, and any pertinent change orders to the testing firm prior to commencement of testing.

E. Notify the Engineer and Owner's Representative prior to commencement of any testing.

F. Any system, material or installation which is found defective on the basis of acceptance tests shall be reported to the Owner's Representative.

G. The testing firm shall maintain a written record of all tests and, upon completion of project, shall assemble and certify a final test report for review and approval by the Engineer of Record.

1.6 ACCEPTANCE TEST PROCEDURES

A. The Acceptance Test Procedure shall include the following sections:
   1. Purpose of Test
   2. References
   3. Test Participants- Name/Company/Telephone Number and hand signed Initials
   4. Equipment and Systems tested.
   5. Description of test.
   6. Acceptance Criteria
   7. Initial Conditions/Prerequisites
   8. Test Equipment and Calibration date
   9. Test Procedure and Date of Test
   10. Test Results-verification of passing acceptance criteria.
   11. Deficiencies, Corrections and Re-test
12. Verification Systems and Equipment are returned to Operational Status
13. Conclusions and recommendations.
14. Appendix, including test forms.

B. Each piece of equipment shall be recorded in the test procedure listing the condition of the equipment as
found and as left. Included shall be recommendations for any necessary repair or replacement parts. The
test procedures shall indicate the name of the engineer who tested the equipment and the date of the test
completion.

C. Inspection Reports may be in situ test reports prepared by manufacturer representatives such as startup
test reports by, for example the UPS or Generator manufacturers' startup representative. The inspection
reports shall indicate the name of the person who inspected the equipment and the date of completion.

D. The Acceptance Test Procedure shall be a step by step procedure to be followed verbatim and initialed
after each step's performance. The test shall include the listed sections above. The procedure shall be
prepared on 8.5" x 11" paper. See Attachment 1 as an example.

1.7 TESTING INSTRUMENT TRACEABILITY
A. All applicable test instrumentation shall be currently calibrated within rated accuracy.
B. The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain.
C. Instruments shall be calibrated in accordance with the following frequency schedule:
   1. Field instruments: 6 months maximum.
   2. Laboratory instruments: 12 months.
   3. Leased specialty equipment: 12 months
D. Dated calibration labels shall be visible on all test equipment.

1.8 FINAL SETTINGS
A. The Contractor shall be responsible for implementing all final settings and adjustments of equipment in
accordance with manufacturer's and/or Engineer's specified values. The Contractor shall be responsible
to request any required setting values from the Engineer.

1.9 SUBMITTALS
A. At least two weeks prior to conducting testing, submit Acceptance Test Procedures and Inspection
Reports for review and approval by the Electrical Engineer of Record. This includes the prepared test
report outlined above including all systems and equipment to be tested (with the test results, deficiencies,
and conclusions sections blank). The Contractor shall be responsible to integrate the testing by the
Contractor, Manufacturing Representatives, and NETA testing organization. The NETA testing
organization shall prepare the Testing Documents per the current NETA Acceptance Testing Specification
and assist the Contractor in preparing an Integrated System Test. The Manufacturing Representative
testing organization shall prepare their regular start up test plan and assist the Contractor in preparing an
Integrated System Test. After review and approval the test report shall be executed.
B. At least two week prior to conduction testing, submit for review and approval by the Engineer the list of
test participants and prove of their qualifications and demonstrate they have the necessary testing
experience and training to conduct the test.
C. Record copies of the completed test report shall be submitted no more than 30 days after completion of
the testing and inspection.

1.10 FAILURE TO MEET TEST
A. Any found defective on the basis of acceptance test shall be reported directly to the Engineer.
B. Contractor shall replace the defective material or equipment and have test repeated until test proves
satisfactory without additional cost to the Owner.
PART 2 - PRODUCTS-NOT USED

PART 3 - EXECUTION

3.1 EQUIPMENT TO BE TESTED AND INSPECTED

A. The following equipment shall be tested in accordance with the scopes of work which follow and additional participation in other acceptance testing such as integrated system and functional testing. Acceptance test procedures and inspection reports shall be prepared, submitted and approved prior to performance of testing and inspections. The party responsible is identified in accordance with the following key: C = Contractor/Installer; M = Manufacturer; T = Testing Agency.

1. Molded Case Circuit Breakers - C
2. Fire Alarm System - M
3. Grounding System - C
4. Cables, Low Voltage, 600 Volts Maximum - C
5. Ground Fault Systems - C
6. Low Voltage Switchgear and Switchboards - T
7. Low Voltage Power Circuit Breakers and Insulated Case Circuit Breakers - T
8. Telecommunications Systems - C or M
9. Other Systems - C, M, T

3.2 INSPECTIONS

A. DRY TYPE TRANSFORMERS

1. Visual and Mechanical Inspection:
   a. With case covers removed, inspect transformer core and coil assembly and enclosure interior. Cloth wipe and brush major insulating surfaces.
   b. Check primary, secondary, and ground connections.
   c. Check tap connections and tap changer.
   d. Inspect all bolted connections. Torque wrench tighten or remake any questionable connections.
   e. Inspect insulators, spacers, and windings.
   f. Inspect for adequate electrical clearance.
   g. Check base or support insulators, including vibration isolation supports.
   h. Check accessory devices for condition and proper operation.
   i. Verify that the transformers have been provided with adequate spacing for ventilation.

B. MOLDED CASE CIRCUIT BREAKERS

1. Visual and Mechanical Inspection:
   a. Inspect cover and case, and check for broken or loose terminals.
   b. Operate breaker to check operation.
   c. Verify proper reporting of the events on the project equipment monitoring system.

2. Electrical Tests (400 ampere frame and larger):
   a. Insulation Resistance Test: Megger main poles of breaker pole-to-pole, from each pole to ground, and across the open contacts of each pole.
b. Contact Resistance Test: Ductor across main pole contacts with breaker closed and latched to check for good, low resistance contact.

c. Test overcurrent trip device and calibrate. Where primary injection testing is specified, test each pole of the breaker individually. Data shall be compared with manufacturer’s published data.

1) All trip units shall be tested by primary injection.
2) Static overcurrent trip devices shall be tested per manufacturer’s instructions.
3) Test for minimum pick-up current.
4) Apply 300% of pick-up current and measure time necessary to trip breaker (long time delay).
5) Where short time delay characteristics are provided, test short time pick-up and delay.
6) Test instantaneous trip by passing current sufficiently high to trip breaker instantaneously.
7) Where ground fault protection is provided, test ground fault pick-up and delay.
8) Check reset characteristics of trip unit.
9) Electrically test any auxiliary devices such as shunt trips, undervoltage trips, alarm switches, and auxiliary switches.

C. FIRE ALARM SYSTEM

1. Visual and Mechanical Inspection:
   a. Inspect each device for physical damage.
   b. Check for proper labeling of conductors.
   c. Inspect all test switches for proper operation.
   d. Inspect all system lamps and LED’s for proper operation. Replace all non-operational equipment.
   e. Check all cabinet doors latches and hinges for proper operation. Adjust, lubricate, and repair as required.
   f. Verify proper reporting of the events on the project equipment monitoring system.

2. Electrical Tests: Test each individual circuit at panel with equipment connected for proper operation. Entire system shall test free from opens, grounds, and short circuits. Verify control circuit integrity: Field tests to verify component compliance with specifications, adjusting, calibrating, and setting circuit breaker, relays, timers, etc. Testing will include, but not be limited to the following:

   a. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   b. Close each sprinkler system control valve and verify proper supervisory alarm at the FACP.
   c. Verify activation of all flow switches.
   d. Open initiating device circuits and verify that the trouble signal actuates.
   e. Open and short signaling line circuits and verify that the trouble signal actuates.
   f. Open and short indicating appliance circuits and verify that trouble signal actuates.
   g. Ground all circuits and verify response of trouble signals.
   h. Check presence and audibility of all alarm notification devices.
   i. Check installation, supervision, and operation of all intelligent smoke detectors.
j. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

k. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

l. Check the integrity of the software program with the system in complete operation. Verify that each message reported is correct with respect to the signal received. All possible operating conditions and system troubles shall be tested. Rewrite software as required.

m. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

n. Close each sprinkler system control valve and verify proper supervisory alarm at the FACP.

o. Verify activation of all flow switches.

p. Open initiating device circuits and verify that the trouble signal actuates.

q. Open and short signaling line circuits and verify that the trouble signal actuates.

r. Open and short indicating appliance circuits and verify that trouble signal actuates.

s. Ground all circuits and verify response of trouble signals.

t. Check presence and audibility of all alarm notification devices.

u. Check installation, supervision, and operation of all intelligent smoke detectors.

v. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

w. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

x. Check the integrity of the software program with the system in complete operation. Verify that each message reported is correct with respect to the signal received. All possible operating conditions and system troubles shall be tested. Rewrite software as required.

D. GROUNDING SYSTEM

1. Visual and Mechanical Inspection:
   a. Inspect wiring system outlet and junction boxes for proper grounding. Green grounding conductor shall be connected to outlet and junction boxes. Inspect a minimum of 5% of project boxes.
   b. Verify connections of grounds for the secondary of separately derived grounding systems, i.e. at dry type transformers. Note type of connection, i.e. mechanical or exothermic.
   c. Verify proper connection to all components of building service entrance grounding system. Note all system components which are interconnected and type of connection either mechanical or exothermic. Note depth of driven ground rods.

2. Electrical Tests (Small Systems):
   a. Perform ground-impedance measurements utilizing the fall-of-potential method per ANSI/IEEE Standard 81 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System". Instrumentation utilized shall be specifically designed for ground impedance testing. Provide sufficient spacing so that plotted curves flatten in the 62% area of the distance between the item under test and the current electrode.
b. Equipment Grounds:
   1) Utilize two-point method of IEEE Std. 81. Measure between equipment ground being
tested and known low-impedance grounding electrode or system.

3. Electrical Tests (Large Systems):
   a. When sufficient spacing of electrodes described above is impractical, perform ground-
impedance measurements utilizing either the intersecting curves method or the slope method.
(Ref. Nos. 40 and 41 in IEEE Std. 81.)

b. Test Values:
   1) The main ground electrode system impedance-to-ground should be no greater than five
(5) ohms. Equipment grounds, depending on size and length of grounding conductor,
should be only fractionally higher than system ground.

E. CABLES - LOW-VOLTAGE - 600V MAXIMUM

1. Visual and Mechanical Inspection:
   a. Inspect cables for physical damage and proper connection in accordance with single-line
diagram.
   b. Test cable mechanical connections to manufacturer's recommended values using a calibrated
torque wrench.
   c. Check cable color-coding with applicable specifications and National Electrical Code
standards.

2. Electrical Tests:
   a. Perform insulation-resistance test on each feeder on the riser diagram with respect to ground
and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
   b. Perform continuity test to insure proper cable connection.
   c. Test Values:
      1) Evaluate results by comparison with cables of same length and type. Investigate any
values less than 50 megohms.
      2) Provide a test report for each feeder which indicates the manufacturer's target values and
actual test reading. Report shall indicated pass/fail for each feeder. Submit report to
Owner's Representative for approval. Include test report in project maintenance manual.
   d. Feeder Cables:
      1) 600-volt feeder cables in the building and secondary service cables to the building shall
be tested using a megohmmeter, to measure the insulation resistance of each conductor
in the circuit.
      2) Disconnect all equipment switches, relays, buswork, transformers, etc.) from the cable
being tested.
      3) Tests to be performed in a dry area.
      4) Clean and dry cable ends with a cloth moistened with a suitable solvent.
   e. e.Cable Values: Cable values shall be established and provided by the cable manufacturer.
Provide target value insulation resistance (IR) in megohms, based on 1000 ft. at 60 Deg F.
   f. Temperature Correction Factor: For temperatures above or below 60°F, a correction factor
may have to be applied to determine the true IR value. However, if the measured IR of the
system is equal to or greater than the calculated value, a correction factor is not needed.
   g. Correct insulation deficiencies which show and insulation resistance of less than one megohm.
h. Test conductors with power off and impress a voltage of not less than 500 volts D.C.
i. Perform continuity tests on all conductors.

F. GROUND-FAULT SYSTEMS (CEC 230-95)

1. Visual and Mechanical Inspection:
   a. Inspect for physical damage and compliance with drawings and specifications.
   b. Inspect neutral main bonding connection to assure:
      1) Zero-sequence sensing system is grounded.
      2) Ground-strap sensing systems are grounded through sensing device.
      3) Ground connection is made ahead of neutral disconnect link on zero-sequence sensing systems.
      4) Grounded conductor (neutral) is solidly grounded.
   c. Inspect control power transformer to ensure adequate capacity for system.
   d. Manually operate monitor panels (if present) for:
      1) Trip test.
      2) No trip test.
      3) Nonautomatic reset.
   e. Record proper operation and test sequence.
   f. Set pickup and time-delay settings in accordance with the settings provided by the University’s Representative.
   g. Verify proper reporting of the events on the project equipment monitoring system.

2. Electrical Tests:
   a. Measure system neutral insulation to ensure no shunt ground paths exist. Remove neutral-ground disconnect link. Measure neutral insulation resistance and replace link.
   b. Determine the relay pickup current by current injection at the sensor and operate the circuit interrupting device.
   c. Test the relay timing by injecting three hundred percent (300%) of pickup current, or as specified by manufacturer.
   d. Test the system operation at fifty-seven percent (57%) rated control voltage, if applicable.
   e. Test zone interlock systems by simultaneous sensor current injection and monitoring zone blocking function.
   f. On multiple source, tie breaker, etc., systems, devise a simulation scheme that fully proves correct operation.
   g. Test Parameters:
      1) System neutral insulation shall be a minimum of one hundred (100) ohms, preferably one (1) megohm or greater.
      2) Relay timing shall be in accordance with manufacturer’s published time-current characteristic curves but in no case longer than one (1) second for fault currents equal to or greater than 3,000 amperes.
      3) Relay pickup value shall be within +10% of setting and in no case greater than 1200A.

G. LOW VOLTAGE PANELBOARD
1. Visual and Mechanical Inspection:
   a. Verify that the enclosure interiors have been cleaned of accumulated dust, dirt, oil films, and other foreign materials.
   b. Inspect all electrical and mechanical components for condition and any evidence of defects or failure.
   c. Check for proper travel and alignment of any draw out or plug-in circuit breakers.
   d. Check breaker connections to bus.
   e. Inspect bolted connections. Torque wrench tighten or remake any questionable connections.
   f. Inspect for missing or loose hardware or accessories.
   g. Inspect ground bus connections.
   h. Operate key and door interlock devices to assure proper operation.
   i. Verify proper reporting of the events on the project equipment monitoring system.

2. Electrical Tests:
   a. Insulation Resistance Test: Megger main secondary bus and feeder circuits phase-to-phase and phase-to-ground.
   b. Energize any space heater circuits to insure proper operations.
   c. Check phase rotation with a Biddle phase rotation meter.
   d. Instruments and Meter Tests:
      1) Inspect panel mounted instruments and meters. Clean and check for calibration accuracy. Make minor adjustments as necessary.

H. LOW VOLTAGE POWER CIRCUIT BREAKERS AND INSULATED CASE CIRCUIT BREAKERS
1. Visual and Mechanical Inspection:
   a. Remove each draw-out type circuit breaker.
   b. Inspect arc chutes of power circuit breakers.
   c. Inspect circuit breaker for defects or damage.
   d. Inspect and check contacts. Check alignment, over-travel, and pressure. Adjust if necessary.
   e. Inspect finger clusters on line and load stabs of draw-out circuit breakers.
   f. Check for proper mechanical operation. Lubricate where necessary.
   g. Check auxiliary devices for proper operation.
   h. Check breaker racking device (if applicable) for alignment and friction-free operation. Lubricate if necessary.
   i. Verify proper reporting of the events on the project equipment monitoring system.

2. Electrical Tests:
   a. Insulation Resistance Test: Megger main poles of breaker pole-to-pole, from each pole to ground, and across the open contacts of each pole.
   b. Contact Resistance Test: Ductor across main pole contacts with breaker closed and latched to check for good, low resistance contact.
   c. Test overcurrent trip device by primary injection and calibrate to settings provided. Static overcurrent trip devices shall be tested per the manufacturer's instructions. Test each pole of the breaker individually. Data shall be compared with manufacturer's published data.
1) Test for minimum pick-up current.
2) Apply 300% of pick-up current and measure time necessary to trip breaker (long time delay).
3) Where short time delay characteristics are provided, test short time pick-up and delay.
4) Test instantaneous trip by passing current sufficiently high to trip breaker instantaneously.
5) Where ground fault protection is provided, test ground fault pick-up and delay.
6) Check reset characteristic of trip unit.

d. Electrically test any auxiliary devices such as shunt trips, undervoltage trips, alarm contacts, and auxiliary contacts.

END OF SECTION
SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY
A. Provide electrical materials, installation and testing for the new relocatable classroom in Sonoma County of Education.

1.2 DESCRIPTION
A. This section describes requirements for wiring devices and connections.

1.3 RELATED WORK
A. Section 26 0100: General Requirements for Electrical Work.
B. Section 26 0526: Grounding.

1.4 REFERENCE STANDARDS
B. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; Current edition.
C. NEMA WD 6 - Wiring Device -- Dimensional Requirements; National Electrical Manufacturers Association; Current edition.
D. CEC - California Electrical Code; most recent edition.

1.5 SUBMITTALS
A. Submit manufacturers' data and shop drawings in accordance with Section 01 3000 - Administrative Requirements and Section 01 6000 - Product Requirements for items listed.
B. Provide submittals for items listed documenting compliance with specification requirements.
C. Product Data:
   1. Electrical Materials: Manufacturer’s current published catalog sheets.

PART 2 - PRODUCTS

2.1 ALL WIRING DEVICES
A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.2 WIRING DEVICES
A. Provide UL listed wiring devices, ivory or color selected by Engineer, with voltage and current ratings specified and wire terminations designed to contain stranded conductors. Provide grounding type receptacles. Provide RED color for all wiring devices connected to the emergency power system.
B. Provide 120 volt single and duplex receptacles which meet Federal Specification W-C-596 as listed:

1. SPECIFICATION GRADE - COMMERCIAL (DESIGNER)
C. Provide receptacles other than 120 volt single and duplex as indicated on drawings.

D. NOT USED.

E. Listed manufacturers establish a standard of quality. Substitutions will be considered in accordance with Section 26 0100, General Requirements for Electrical Work.

F. NOT USED.

G. Wall Plates: Type 302 stainless steel, satin finish, minimum 0.040 inch thick, single or multiple gang.

PART 3 - EXECUTION

3.1 WIRING DEVICES

A. Connect wiring devices to circuits indicated using side or back wiring terminals, designed to contain stranded wire.

B. Connect green grounding pigtail from receptacles to outlet box with screw.

C. Install wiring devices flush with the device plate fronts.

D. Align plates plumb with wall, and cover opening, without use of "jumbo" plates.

END OF SECTION
SECTION 28 31 00
FIRE ALARM INTEGRATED SAFETY SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and conditions of the contract, including but not limited to General Conditions, and the Special Conditions listed below, apply to work of this section.
   1. Supplementary Instructions to Bidders.
   2. Supplementary Conditions.
   4. Project Coordination.
   5. Cutting and Patching.
   6. Definitions and Standards.
   7. Submittals.
   8. Schedules and Reports.
  10. Security Regulations.
  11. Safety and Health.
  12. Products.
  13. Project Closeout.
  14. Section 26 01 00 – General Requirements of Electrical Work
  15. Section 26 05 02 – Supporting from Building Structure
  16. Section 26 05 34 – Conduit
  17. Section 26 05 37 – Boxes

1.2 PROJECT/WORK IDENTIFICATION

A. Contract documents indicate the work of the contract, related requirements and conditions that have an impact on the project. Related requirements and conditions that are indicated on the contract documents include, but are not necessarily limited to, the following:
   B. Existing site conditions and restrictions.
   C. Other work prior to work of contract.
   D. Alterations and coordination with existing work.
   E. Other work to be performed concurrently by Owner.
   F. Other work to be performed concurrently by separate contractors.
   G. Other work subsequent to work of Contract.
   H. Requirements for occupancy by Owner prior to completion of work of contract.

1.3 SUMMARY – FIRE

A. This performance specification provides the minimum requirements for the Life Safety System. The system shall include, but not limited to all equipment, materials, labor, documentation and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:
   1. Smoke, heat detection.
   2. Off-premise notification.
1.4 PROJECT REPRESENTATIVES
A. All contacts with the Project Building shall be directed to the Owner's Representative, hereafter referred to as the Architect.

1.5 INTERPRETATION
A. No interpretations of the meaning of the bid documents will be made to any bidder orally. Each request for such interpretation shall be made to the engineer in writing, addressed to the Architect of Record.
B. Written requests for interpretation will be received until 10 days prior to bid date.

1.6 MANUFACTURER
A. Acceptable fire alarm system manufacturers include:
1. Silent Knight, Copper Wheelock, System Sensor.
2. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system and smoke control system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
3. The contractor shall provide, from the acceptable manufacturer's current product lines, equipment and components, which comply, with the requirements of these specifications. Equipment or components, which do not provide the performance and features, required by these specifications are not acceptable, regardless of manufacturer.

1.7 ALTERNATES – FIRE
A. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed and will accommodate the future requirements and operations of the building owner. All specified operational features must be met without exception.
B. The authorized representative of the manufacturer of the major equipment shall be responsible for the satisfactory installation of the complete system.
C. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling system, access control, and smoke control. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
D. All control panel assemblies and connected field appliances shall be provided by the same system supplier, and shall be designed and tested to ensure that the system operates as specified. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, as described in this specification.
E. All equipment and components shall be installed in strict compliance with the manufacturer's recommendations.
F. The equipment to be supplied will be considered only if it meets all sections of the
performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

G. A complete description of proposed alternate system performance methods with three (3) copies of working drawings thereof for approval by the Owner, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

H. The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Owner, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

I. The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph as written, placing the word “comply” opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point by point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

J. The acceptability of any alternate proposed system shall be the sole decision of the Owner or his authorized representative.

1.8 REFERENCES

A. Definitions and abbreviations – general:

1. ADA: Americans with Disabilities Act.
2. AFF: Above Finished Floor.
3. AHJ: Authority Having Jurisdiction.
4. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Authority or AHJ.
5. Circuit: Wire path from a group of devices or appliances to a control panel or transponder.
6. CPU: The central computer of a multiplex fire alarm or voice command control system.
7. CRC: Card Reader Controller
8. CRT: Cathode Ray Tube.
10. FCC: Fire Command Center.
11. FSCP: Firefighter's Smoke Control Panel
12. HVAC: Heating Ventilating and Air Conditioning.
15. LCD: Liquid Crystal Display.
17. NAC: Notification Appliance Circuit.
18. NCP: Local Network Control Panel.
19. PTR: Printer.
20. RCP Remote Control Panel
22. Style 1: As defined by NFPA 72, Class B.
23. Style 4: As defined by NFPA 72, Class B.
24. Style 6: As defined by NFPA 72, Class A.
25. Style 7: As defined by NFPA 72, Class A.
26. Style B: As defined in NFPA 72, Class B.
27. Style D: As defined in NFPA 72, Class A.
28. Style Y: As defined in NFPA 72, Class B.
29. UL or ULI: Underwriters Laboratories, Inc.
30. UL Listed: Materials or equipment listed and included in the most recent edition of the UL Fire Protection Equipment Directory.
31. Zone: Combination of one or more circuits or devices in a defined building area, i.e. 3 speaker circuits on a floor combined to form a single zone.

1.9 CODES – GENERAL

A. All work and materials shall conform to all applicable Federal, State and local codes and regulations governing the installation. If there is a conflict between the referenced standards, federal, state or local codes, and this specification, it is the bidder's responsibility to immediately bring the conflict to the attention of the Engineer for resolution. National standards shall prevail unless local codes are more stringent. The bidder shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the Engineer.

B. System components proposed in this specification shall be ULI listed to operate together as a system. The supplier shall provide evidence, with his submittal, of listings of all proposed equipment and combinations of equipment. The supplier shall be responsible for filing of all documents, paying all fees (including, but not limited to plan checking and permit) and securing all permits, inspections and approvals. Upon receipt of approved drawings from the authority having jurisdiction, the supplier shall immediately forward two sets of drawings to the Owner. These drawings shall either be stamped approved or a copy of the letter stating approval shall be included.

1.10 CODES - FIRE

A. The equipment and installation shall comply with the current provisions of the following codes and standards:

4. UL 864 - Control Units for Fire Protective Signaling Systems.
5. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
6. UL 268A - Smoke Detectors for Duct Applications.
7. UL 217 - Single and Multiple Station Smoke Alarms
9. UL 464 - Audible Signaling Appliances.
11. UL 1971 - Signaling Devices for the Hearing-Impaired.
14. UL 1635 - Digital Alarm Communicator System Units.
15. Department of State Architect.
17. Federal Codes and Regulations.
18. Americans with Disabilities Act (ADA).
19. Faory Mutual (FM) approval.
   a. ISO-9000
   b. ISO-9001

1.11 SYSTEM DESCRIPTION

A. General – Fire: The Contractor shall furnish all labor, services and materials necessary to furnish and install a complete, functional fire alarm system. The System shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.

B. It is further intended that upon completion of this work, the Owner be provided with:
   1. Complete information and drawings describing and depicting the entire system(s) as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system(s) at a future date.
   2. Complete documentation of system(s) testing.
   3. Certification that the entire system(s) has/have been inspected and tested, is/are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is/are in proper working order. Fire Alarm System shall be tested only when the system is 100% complete. Contractor shall use "Fire Alarm System Certification and Description" as required by NFPA 72 - 2019 edition.
   4. Manufacturer supplied training to allow district personnel to access and program Fire Alarm system.

1.12 DESCRIPTION – FIRE

A. Provide and install a new fire detection and alarm system consisting of:
   1. New fire alarm control panel and voice evacuation system control panel located as shown on the drawings.
   2. Manual pull stations shall be located as shown on the drawings.
   3. Area smoke detection shall be provided as shown on drawings.
   4. Area heat detection shall be provided as shown on drawings.
   5. Provide audible appliances located throughout the building(s), as shown on the drawings.
   6. Provide synchronized visual appliances located throughout the building, as shown on the drawings.
   7. Provide connection to monitoring station.

1.13 SEQUENCE OF OPERATIONS

A. General:
   1. Upon the alarm activation of any area smoke detector, heat detector, manual pull station, duct detector, the following functions shall automatically occur:
2. The internal audible device shall sound at the control panel or command center.
3. The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.
4. All system activity/events shall be documented on the system printer.
5. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
6. Activate notification audible. Notification upon activation of a carbon monoxide detector shall be descriptively annunciated such that audible notification for fire alarm is different than notification for carbon monoxide alarm.
7. Activate visual strobes notification appliances. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.
8. Transmit signal to the central station with point identification.
10. All automatic events programmed to the alarm point shall be executed and the associated outputs activate
11. All self-closing fire/smoke doors held open shall be released.
12. Transmit alarm text messages to "alpha-numerical" display pagers.

B. Supervisory Operation:
1. Upon supervisory activation of any sprinkler valve supervisory switch, the following functions shall automatically occur:
2. The internal audible device shall sound at the control panel or command center.
3. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
4. All system activity/events shall be documented on the system printer.
5. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
6. Transmit signal to the central station with point identification.
7. Activate notification audible. Notification upon activation of a carbon monoxide detector shall be descriptively annunciated such that audible notification for fire alarm is different than notification for carbon monoxide alarm.
8. Activate visual strobes notification appliances. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.

C. Trouble Operation:
1. Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
2. The internal audible device shall sound at the control panel or command center.
3. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.
4. All system activity/events shall be documented on the system printer.
5. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
6. Transmit signal to the central station with point identification.

D. Monitor Activation:
1. Upon activation of any device connected to a monitor circuit, the following functions shall automatically occur:
2. The internal audible device shall sound at the control panel or command center.
3. The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time/date.
4. All system activity/events shall be documented on the system printer.
5. Any remote or local annunciator LCD/LED’s associated with the status zone shall be illuminated.

1.14 SYSTEM CONFIGURATION

A. General: All Life Safety System equipment shall be arranged and programmed to provide the early detection of fire, the notification of building occupants, the automatic summoning of the local fire department, the override of the HVAC system operation, and the activation of other auxiliary systems to inhibit the spread of smoke and fire, and to facilitate the safe evacuation of building occupants.

B. Power Supply: Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for 24 hours and capable of operating the system for 15 minutes in the alarm mode at 100% load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

C. Display: The main display interface shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never intermix to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.

D. Initiating Device Circuits: Initiating device circuits monitoring manual fire alarm stations, smoke and heat detectors, duct detectors, carbon monoxide detectors, shall be Class B (Style "A" or "B").

E. Notification Appliance Circuits: All notification appliance circuits shall be Class B (Style "Y"). All notification appliance circuits shall have a minimum circuit output rating of: 2 amps @ 24 vdc. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

F. Signaling Line Circuits:
   1. When a signaling line circuit covers more than one fire/smoke compartment, a wire-to-wire short shall not effect the operation of the circuit from the other fire/smoke compartments. The signaling line circuit connecting network panel/nodes, annunciators, command centers, shall be Class A (style 7). The media shall be copper except where fiber optic cable is specified on the drawings.
   2. The signaling line circuit connecting to addressable/analog devices including, detectors, monitor modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class B (style 4).
   3. The signaling line circuit connecting to the audio communications (pre-amp signal), amplifiers, and nodes shall be Class B (style 4). The circuit shall be power limited.
   4. The signaling line circuit connecting to the two-way communications circuit (riser) shall be Class B (style 4).

G. DACT:
   1. The system shall provide off premise communications capability (DACT) for transmitting system events to multiple Central Monitoring Station (CMS) receivers.
   2. The DACT shall be installed internal to the FACP panel.
   3. Coordinate reporting information with district representative.

1.15 SUBMITTALS
A. **Project:**
1. The contractor shall purchase no equipment for the system specified herein until the owner has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The contractor shall submit three (3) complete sets of documentation within 30 calendar days after award of purchase order.
2. Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the contract documents. In addition the Contractor shall provide specific notation on each shop drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.
3. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, and address, date including revisions, and preparer and reviewer's initials.

B. **Product Data:** Data sheets with the printed logo or trademark of the manufacturer for all equipment. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Architect/Engineer.

C. **Shop Drawings:**
1. A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:
   a. Control panel wiring and interconnection schematics.
   b. Complete point-to-point wiring diagrams.
   c. Riser diagrams.
   d. Complete floor plan drawing locating all system devices and 1/4' = 1'-0 scale plan and elevation of all equipment in the Fire Command Station. Including showing the placement of each individual item of fire alarm, security, and access control equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
   e. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.
   f. Complete system bill of material.
   g. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET certification in fire protection engineering technology, subfield of fire alarm systems.

D. **Samples:** A sample of each smoke detector, intelligent modules, speaker, strobes, card reader controller, card reader, and door locking mechanism shall be provided to the contractor for their familiarization.

E. **Quality Assurance /Control Submittals – Installer's Certification:**
1. The engineered systems distributor must be licensed in the state of project location and have been incorporated in the business in that state for a minimum of 5 years.
2. Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.
F. System Calculations: Complete calculations shall be provided which show the electrical load on the following system components:
1. Each system power supply, including stand alone booster supplies.
2. Each standby power supply (batteries).
3. Each notification appliance circuit.
4. Each auxiliary control circuit that draws power from any system power supply.

G. Close Out:
1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. The close out submittals shall include:
   a. Project specific operating manuals covering the installed integrated life safety system. The manual shall contain a detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. Manufacturer's data sheets and installation manuals/instructions for all equipment supplied. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
2. As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system. Supply one set of as-built drawings, to be installed in lockable print holder (tube style) located at Main FACP, on site.
3. All drawings shall be provided in standard .DXF format. A vellum plot of each sheet shall also be provided.
4. The application program listing for the system as installed at the time of acceptance by the building owner and/or local AHJ (disk, hard copy printout, and all required passwords).
5. Provide the name, address and telephone of the authorized factory representative.
6. A filled out Record of Completion similar to NFPA 72, 2002 edition figure 4.5.2.1.
7. Provide a detailed test report of the final commissioning of the Fire Alarm System. Report shall include the number of devices installed within each building.

1.16 QUALITY ASSURANCE
A. Qualifications of Contractor – Fire:
1. The contractor shall have successfully installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable size and complexity. The owner reserves the right to reject any control components for which evidence of a successful prior installation performed by the contractor cannot be provided.
2. The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment. Qualified and approved representatives of the system manufacturer shall produce all panel and
equipment drawings and submittals, operating manuals.  The contractor is responsible for retaining qualified and approved representative(s) of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

B.  Pre-installation requirements:
1. The provider shall submit a detailed project plan that will describe in detail how the provider will approach the project, from inception to finalization. The plan must include at a minimum the following information:
   a. Project Staging
   b. Project Management
   c. Equipment Schedules
   d. Installation Time Lines
   e. Other Trade Requirements
   f. Final Acceptance Testing
   g. Personnel Resumes
   h. Progress Report Sample
2. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the manufacturer's riser/connection diagram and details for all specific system installation/termination/wiring data.

C.  Start and Completion Dates: The starting and completion dates for this work will be established at the pre-bid meeting.

1.17 DELIVERY, STORAGE AND HANDLING
A. Receiving and Handling:
   1. The Contractor shall be responsible for all receiving, handling, and storage of his materials at the job site.
   2. Use of loading docks, service driveways, and freight elevators shall be coordinated with the Owner.

1.18 PROJECT CONDITIONS
A. It shall be the Contractor's responsibility to inspect the job site and become familiar with the conditions under which the work will be performed. Inspection of the building may be made by appointment with the Owner. Contractors are requested to inspect the building prior to the pre-bid meeting.
B. A pre-bid meeting will be held to familiarize the Contractors with the project. Failure to attend the pre-bid meeting may be considered cause for rejection of the Contractor's bid. The minutes of this meeting will be distributed to all attendees and shall constitute an addendum to these specifications.
C. The Contractor shall be responsible for prior coordination of all work and demolition with the Owner.

1.19 WARRANTY AND MAINTENANCE
A.  Spare Parts – Fire: The Contractor shall supply the following spare parts:
   1. Automatic detection devices - Two (2) percent of the installed quantity of each type.
   2. Manual fire alarm stations - Two (2) percent of the installed quantity of each type.
3. Audible and visible devices - One (1) percent of the installed quantity of each type, but no less than two (2) devices.
4. Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

B. Warranty:
1. The contractor shall warranty all materials, installation and workmanship for one (1) year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.
2. The System Supplier shall maintain a service organization with adequate spare parts stock within 25 miles of the installation. Any defects that render the system inoperative shall be repaired within 24 hours of the owner notifying the contractor.

1.20 TRAINING
A. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the building owner, detailing the proper operation of the installed System.
B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.
D. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

PART 2 - PRODUCTS
2.1 MANUFACTURER – FIRE
A. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.
B. All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.
C. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification.

2.2 PANEL COMPONENTS & FUNCTIONS
A. Control Panel:
1. New fire alarm control pane Silent Knight 6820EVS.
2.3 FIELD MOUNTED SYSTEM COMPONENTS – FIRE INITIATING DEVICES

A. Analog Addressable Smoke – General:
   1. Smoke detectors shall be photoelectric type, ceiling mounted. The combination
detector head and twist lock base shall be U.L. listed compatible with the fire
alarm control panel. The base shall permit direct interchange with other type of
detectors.
   2. The smoke detector shall have a flashing status LED for visual supervision.
      When the detector is actuated, the flashing LED will latch on steady at full
      brilliance. The detector may be reset by actuating the control panel's reset
      switch. The sensitivity of the detector shall be capable of being selected and
      measured by the control panel without the need for external test equipment. The
      vandal security-locking feature shall be used in those areas as indicated on the
drawing.
   3. The locking feature shall be field selectable when required. It shall be possible to
      perform a sensitivity test of the detector without the need of generating smoke.
      The test method shall simulate the effects of products of combustion in the
      chamber to ensure testing of the detector circuits.
   4. Detectors shall have completely closed back to restrict entry of dust and air
turbulence and have a 30-mesh insect screen. Electronics of the unit shall be
      shielded to protect against false alarms from E.M.I. and R.F.I.

B. Heat Detectors:
   1. Furnish and install analog/addressable heat detectors as described on the plans.
The combination heat detector and twist lock base shall be U.L. listed compatible
with the fire alarm control panel. The base shall permit direct interchange with
other detectors.
   2. The heat detector shall have a flashing status LED for visual supervision. When
      the detector is actuated, the flashing LED will latch on steady at full brilliance.
The detector may be reset by actuating the control panel's reset switch. The
      vandal security-locking feature shall be used in those areas as indicated on the
drawings. Electronics of the unit shall be shielded to protect against false alarms
from E.M.I. and R.F.I.

C. Intelligent Pull Station: Furnish and install addressable single action pull station requiring
only one motion to activate the station.

2.4 NOTIFICATION APPLIANCES

A. Low Profile Speakers: Provide low profile wall mount speakers at the locations shown
on the drawings. The speaker shall provide an 84 dBA sound output at 10 ft. when
measured in reverberation room per UL-464. The speaker shall have a selectable steady
or synchronized temporal output. In and out screw terminals shall be provided for wiring.
The speaker shall mount in a North American 1-gang box.

B. Low Profile Speaker-Strobes: Provide low profile wall mount speaker/strobes at the
locations shown on the drawings. The speaker/strobe shall provide an audible output of
84 dBA at 10 ft. when measured in reverberation room per UL-464. Strobes shall provide
synchronized flash outputs. The strobe output shall be determined as required by its
specific location and application from a family of 15cd, 30cd, 60cd, 75cd & 110cd
devices. The speaker shall have a selectable steady or synchronized temporal output. In
and out screw terminals shall be provided for wiring. Low profile speaker/strobes shall
mount in a North American 1-gang box.

C. Low Profile Strobes: Provide low profile wall mounted strobes at the locations shown on
the drawings. In and out screw terminals shall be provided for wiring. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd, or 110cd devices. Low profile strobes shall mount in a North American 1-gang box.

D. General:
1. All appliances which are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADA AG), and shall be UL 1971 Listed.
2. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.
3. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended. All strobes shall be provided with lens markings oriented for wall mounting.
4. All notification appliances shall be red unless noted otherwise on the drawings.

2.5 INITIATION & CONTROL MODULES

A. Relay Module: Provide addressable control relay circuit modules at the locations shown on the drawings. The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware.

B. Monitor Module: Provide addressable monitor modules at the locations shown on the drawings. The monitor module shall support Class A supervised or Class B supervised wiring to the load device.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Sequence:
1. Installation of the systems shall be conducted in stages and phased such that circuits and equipment are installed in the following order:
2. Riser conduits, AC power conduits and control cabinets.
3. Fire command center, remote control panel(s), control component(s), annunciator(s), remote CRT terminal(s), and printer(s). Provide temporary mounting of fire command center in <location>.
4. Conduits and wiring for complete notification circuits and appliance installation throughout facility.
5. Pre-test the audible and visual notification appliance circuits.
6. Install all new detection devices.
7. Terminations between field devices and the associated control equipment.
8. The detection system shall be switched over and end of each day the system shall be operational. At no time will the system be placed out of service over night.
9. Complete the interface to the building automation system.
10. Complete contractor pre-test of system.
11. Complete system testing.

B. General: All equipment shall be attached to walls and ceiling/floor assemblies and shall be mounted firmly in place. Detectors shall not be supported solely by suspended ceilings. Fasteners and supports shall be sized to support the required load.

C. Conductors:
1. The requirement of this section apply to all system conductors, including all signaling line, initiating device, notification appliance, auxiliary function, remote signaling, AC and DC power and grounding/shield drain circuits, and any other wiring installed by the Contractor pursuant to the requirements of these Specifications.
2. All circuits shall be rated power limited in accordance with NEC Article 760.
3. Installed in conduit or enclosed raceway.
4. The existing cable/wiring may be re-used providing they meet the manufacturer's published wiring requirements.
5. All new system conductors shall be of the type(s) specified herein.
6. All initiating circuit, signaling line circuit, AC power conductors, shield drain conductors and grounding conductors, shall be solid copper, stranded or bunch tinned (bonded) stranded copper.
7. All signaling line circuits, including all addressable initiating device circuits shall be 16 AWG minimum multi-conductor jacketed twisted cable or twisted shielded or as per manufacturer's requirements.
8. All notification appliance circuit conductors shall be solid copper or bunch tinned (bonded) stranded copper. Where stranded conductors are utilized, a maximum of 19 strands shall be permitted for No. 12 and larger conductors.
9. All audible notification appliance circuits shall be 12 AWG minimum twisted pairs or twisted pairs shielded or per manufacturer’s requirements.
10. All visual notification appliance circuits shall be 12 AWG minimum THHN or twisted pairs or twisted shielded pairs or per manufacturer's requirements.

D. Conductors and Raceway:
1. Except as otherwise required by, the installation of all system circuits shall conform to the requirements of Article 760 and raceway installation to the applicable sections of Chapter 3 of NFPA 70 - 2019, National Electrical Code. Fire alarm circuit wiring shall include all circuits described in Section 760-1 including Fine Print Note No. 1 (FPN No. 1), and as defined by the manufacturer's UL listing.
2. The entire system shall be installed in a skillful manner in accordance with approved manufacturer's installation manuals, shop drawings and wiring diagrams. The contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation. All wiring shall be of the type required by the NEC and approved by local authorities having jurisdiction for the purpose.
3. Any shorts, opens, or grounds found on new or existing wiring shall be corrected prior to the connection of these wires to any panel component or field device.
4. The contractor shall neatly tie-wrap all field-wiring conductors in the gutter spaces of the control panels and secure the wiring away from all circuit boards and control equipment components. All field-wiring circuits shall be neatly and legibly labeled in the control panel. No wiring except home runs from life safety system circuits and system power supply circuits shall be permitted in the control panel enclosures. No wiring splices shall be permitted in a control panel enclosure.
5. All penetration of floor slabs and firewalls shall be firestopped in accordance with...
E. Conduit Raceway:
1. All systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems maybe installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
2. The requirements of this section apply to all system conduits, raceways, electrical enclosures, junction boxes, pull boxes and device back boxes.
3. All system conduits shall be of the sizes and types specified.
4. All system conduits shall be EMT, 3/4-inch minimum, except for flexible metallic conduit used for whips to devices only, maximum length 6 feet, 3/4-inch diameter, minimum.
5. All system conduits shall be installed in accordance with Electrical Specifications Sections in Division 26.
6. Conduits shall be sized according to the conductors contained therein. Cross sectional area percentage fill for system conduits shall not exceed 40%.
7. Provide all new conduit raceway and conduit riser.
8. Existing conduit raceway system may be re-used where possible.
9. All fire alarm conduit systems shall be routed and installed to minimize the potential for physical, mechanical or by fire damage, and so as not to interfere with existing building systems, facilities or equipment, and to facilitate service and minimize maintenance.
10. All conduits, except flexible conduit whips to devices, shall be solidly attached to building structural members, ceiling slabs or permanent walls. Conduits shall not be attached to existing conduit, duct work, cable trays, other ceiling equipment, drop ceiling hangers/grids or partition walls, except where necessary to connect to initiating, notification, or auxiliary function devices.
11. All system conduits, junction boxes, pull boxes, terminal cabinets, electrical enclosures and device back boxes shall be readily accessible for inspection, testing, service and maintenance.

F. Identification and Labels:
1. Label each FACP with a printed label that contains the following information:
2. Fire alarm panel number.
3. Supply power feed designation.
4. Label wires at each device with the designated zone and device number.
5. Submit and affix in a clear folder, to the inside door of the control panel, a plot plan of the site that will identify the following:
   a. Location of each fire Alarm Control Panel
   b. Location of supply power for each control panel
   c. General location of the designated zone as per the FACP programming.

3.2 FIELD QUALITY CONTROL – TESTING AND INSPECTIONS
A. All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message.
B. All wiring shall be tested for continuity, shorts, and grounds before the system is activated.
C. All test equipment, instruments, tools and labor required to conduct the tests shall be made available by the installing contractor.
D. The system including all its sequence of operations shall be demonstrated to the Owner,
his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

E. A final 100% test & inspection shall be performed by a factory trained representative of the system manufacturer only when the system is 100% complete. At the final 100% test and inspection, the representative shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision and participate during all of the testing for the system.

F. All fire alarm testing shall be in accordance with National Fire Alarm Code, NFPA 72 - 2016, Chapter 7.

G. A letter from the Contractor certifying that the system is installed entirely in accordance with the system manufacturer’s recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.

END OF SECTION
SECTION 31 11 00

CLEARING, GRUBBING AND DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work includes but not limited to the following:
   1. Removal and disposal of vegetation and debris and minor demolition within the limits of earthwork
   2. Removal and disposal of fencing
   3. Removal and disposal of barricade
   4. Demolition and disposal of concrete curb and gutter
   5. Demolition and disposal of existing asphalt paving
   6. Demolition and disposal of miscellaneous concrete slab

B. The Contractor shall protect all trees and all other vegetation not slated for demolition. Prior to commencing construction, the contractor shall install temporary fencing, flagging or equivalent at the perimeter of all vegetated areas and/or individual trees to be preserved, temporary facilities, and any other improvements onsite. Prior to commencing work, the contractor shall review all tree and other protection fencing with School District Representative, and field adjust the limits as directed by the Engineer.

C. The Contractor shall remove and dispose debris of site including trees, shrubs, rock, asphalt pavement, concrete, rubble, debris, vegetative matter and other items which may exist within the limits of work.

D. Unless shown to be removed or altered, existing improvements and facilities, utilities, adjacent property, trees and plants are not to be removed and shall be protected from injury or damage.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 SEQUENCE

A. Prior to start of clearing operations, the Contractor shall have installed tree protection fencing (per this section) and silt fencing per SWPPP.

B. Clearing and grubbing operations shall proceed in an organized manner in advance of earthwork and structure installation. Clearing and grubbing shall be sequenced by area such that earthwork begins immediately after an area being cleared and grubbed. Clearing and grubbing operations shall also be sequenced to minimize dust generation and erosion at the site.

3.02 CLEARING AND GRUBBING

A. Limit clearing to two (2) feet beyond limits of earthwork.

B. Areas shall be cleared and grubbed by removing obstructions, trees, shrubs, grass, and other vegetation. Removal includes digging out stumps and obstructions and grubbing
roots. Completely remove stumps, roots, obstructions, and debris extending to a depth of 6-inches below subgrade. Use only hand methods for grubbing within drip line of remaining trees.

C. The Contractor shall take care to avoid damaging any trees or native herbaceous plants designated to remain.

3.07 MINOR DEMOLITION AND DEBRIS REMOVAL

A. Remove any man-made structures to prevent interference with the work outlined within these specifications, whether or not shown on the Plans. Known man made material onsite include, but are not limited to, curb and gutter, asphalt paving, miscellaneous concrete, wooden barricades, fencing, and miscellaneous water, sewer, and recycled water facilities.

B. Remove incidental debris encountered during clearing and grubbing activities and segregate and dispose of debris offsite.

C. Except for materials indicated to be stockpiled or to remain, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.

3.08 CONCRETE AND ASPHALT DEMOLITION

A. Concrete and asphalt shall be sawcut in neat straight lines that are acceptable as future conform locations.

B. Material may be recycled and re-used in road base if properly processed and:
   a) It meets the project specifications for road base.
   b) The contractor shall submit recycle and re-use specification to the engineer for approval.

C. Except for materials re-used onsite, demolished materials are the Contractor's property. Remove materials from site and dispose of in lawful manner.

MEASUREMENT AND PAYMENT

The contract lump sum price paid under Clearing, Grubbing and Demolition shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in mobilization as specified herein and conforming to the provisions of this section and no additional compensation will be allowed therefore.

*** END OF SECTION ***
SECTION 31 20 00
EARTHWORK

PART I - GENERAL

1.01 DESCRIPTION

A. This section applies to all earthwork required for the project and shall include and not be limited to:

1. Excavation
2. Excavation and replacing unsuitable material
3. Rough grading
4. Subgrade preparation
5. Geogrid for subgrade stabilization (if required)
6. Chemical amendments of soils (lime treatment or approved equal if required)
7. Installation of pavement fabric (if required)
8. Construction of slopes and embankment
9. Sheeting, Shoring and Bracing
10. Dewatering
11. Import Fill
12. Grading, spreading and compaction
13. Export - Off haul of excess or unsuitable material
14. All other subsidiary work necessary to complete the grading of the roadway areas in conformance with the lines, grades and slopes as shown on the Plans and as specified in the Special Provisions.

B. Earthwork shall conform to Section 19 "Earthwork" of the Caltrans Standard Specifications, and these special provisions.

C. The Contractor shall provide all materials, equipment and labor necessary to furnish and construct the roadway subgrade and all appurtenant work, complete in place, as shown on the Plans and specified herein.

D. Engineer

1. Where specific reference is made to Engineer; this designation shall be understood to include either the owner’s engineer or their representative, the Geotechnical Engineer.

E. Pavement Subgrade Performance Requirements

1. Import soils and/or chemically amended import and/or native soils shall be used to establish the upper 12 inches of the final subgrade levels to achieve a minimum R-value of 40.

2. The contractor shall determine the type and quantity of chemical amendment to be used to achieve a minimum R-value of 40. The contractor shall submit laboratory testing to establish that the soil meets the requirements of the Contract Documents.
F. Geogrid SEG<sub>G</sub>

If during construction the soils are pumping or rutting due to excessive moisture, and the contractor is not able to achieve the specified compaction, Geogrid SEG<sub>G</sub> can be used to stabilize the subgrade and allow for placement of engineered fill and aggregate base for the paving section.

G. Export

1. Surplus material and material deemed not suitable for the project shall be removed from the site and disposed by the contractor. The contractor shall obtain authorization from the Engineer before disposing of surplus or unsuitable material.

2. The contractor shall submit in writing to the Engineer that the soil does not meet the requirements of the Contract Documents. The quantity of soil to be exported shall also be submitted by the contractor. The Engineer shall verify and approve export of unsuitable or surplus soil.

3. Disposal of surplus material prematurely and later finding a material shortage is the contractor responsibility to replace at no cost to the owner.

1.02 PROTECTION

A. 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.

B. Adequate protection measures shall be provided at the site to protect workmen. The site will be protected from the public. The site shall be fully protected throughout the operations.

C. Excavation, trenching and shoring shall be in accordance with Occupational Safety & Health Administration (OSHA). Attention is directed to Section 31 4100, “Sheeting, Shoring and Bracing,” of the Special Provisions.

D. The Contractor shall excavate the length of trench that can be completed for that day. In the event that trench will remain open it shall be plated and barricaded.

E. Any construction review of the Contractor's performance conducted by the Engineer or 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.

F. Dewatering activity shall be in compliance with the General Construction Permit. Dewatering discharge shall not cause erosion, scour, or sedimentary deposits that impact natural bedding materials. Attention is directed to Section B.14, “Dewatering,” of the Special Provisions.

G. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

H. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.

I. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.03 GEOTECHNICAL REPORT – Not Applicable
1.04 EXISTING SITE CONDITIONS

A. The Contractor shall be acquainted with all site conditions. If unknown active utilities are encountered during the work, the Engineer shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor’s operations subsequent to his/her discovery of such unknown utilities.

1.05 SEASONAL LIMITS

A. Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When heavy rains interrupt the work, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

1.06 SUBMITTALS

A. Contractor shall submit source and material submittal prepared by a certified laboratory to the Engineer for review and approval.
B. Accompanying the material submittal, submit materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceed, specified requirements.
C. Contractor shall submit tickets for each load of import fill.
D. Submit certificate of compliance for other items.

PART II: PRODUCTS

2.01 MATERIALS

A. Imported Fill Materials
   Imported fill materials shall be approved by the Engineer and shall be of three-inch (3") maximum particle size. Import materials also shall be free of known contaminants and have corrosion characteristics within acceptable limits, with appropriate documentation provided by the contractor. Import fill within the upper 12 inches of the final subgrade shall meet a minimum R-value of 40 or be chemically amended to achieve an R-value of 40.

B. Local Soils
   All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local soils free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Engineer prior to use. Local soils within the upper 12 inches of the final subgrade shall meet a minimum R-value of 40 or be chemically amended to achieve an R-value of 40.

C. Treated Soils
   Materials to be chemically-stabilized shall be on-site or imported soils free from significant quantities of rubble, rubbish and vegetation and shall have been tested and approved by the Engineer. Treated soils shall meet a minimum R-value of 40.

D. Lime
   1. Lime shall be high-calcium or dolomitic quicklime conforming to the definitions in ASTM Designation C 51. When sampled by the Engineer from the lime spreader...
or during the spreading operations, the sample of lime shall conform to the following requirements:

a. High-calcium quicklime shall contain not less than 113 percent (113%) calcium hydroxide \(\text{Ca(OH)}_2\), as determined by California Test Method 414.

b. Dolomitic quicklime shall contain not less than fifty-seven percent (57%) calcium oxide, \(\text{CaO}\), and not less than ninety-five percent (95%) combined calcium oxide, \(\text{CaO}\), and magnesium oxide, \(\text{MgO}\), as determined by California Test 404.

c. When dry sieved in a mechanical sieve shaker for 10 minutes +30 seconds, a 250-gram test sample of quicklime shall conform to the following grading requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>98 - 100</td>
</tr>
<tr>
<td>No. 100</td>
<td>0 - 25</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 - 15</td>
</tr>
</tbody>
</table>

2. In addition to the above, the use of alternative lime products which are of equal quality and of the required characteristics for the purpose intended will be permitted, subject to the following requirements:

a. The burden of proof as to quality and suitability of alternatives shall be upon the Contractor and/or Supplier and he shall furnish test data and all information necessary, as required by the Engineer. Written request for alternatives, accompanied by complete data as to the quality and suitability of the material shall be made in ample time to permit testing and approval without delaying the work. The Engineer shall be the sole judge as to the quality and suitability of alternatives and his decision shall be final. Documentation shall be provided to the Engineer no later than two weeks before the alternative material is imported to the site.

c. The lime shall be protected from moisture until used and shall be sufficiently dry to flow freely when handled.

d. A Certificate of Compliance in accordance with Caltrans Specification 6-1.07 shall be furnished with each delivery of lime and shall be submitted to the Engineer with a certified copy of the weight of each delivery.

E. Cement

Cement shall be Type II Portland cement

F. Water

Water for use in subgrade stabilization shall be clean and potable and shall be added during mixing, remixing and compaction operations, and during the curing period to keep the cured material moist until covered.

G. Geogrid SEG\(_G\) shall be per California Department of Transportation Subgrade Enhancement Geosynthetic Design and Construction Guide placed in accordance with manufacturer’s recommendations.

H. Other Products
Aggregate base, asphalt concrete and related asphalt seal coats, tack coat, etc., shall comply with the appropriate provisions of the most current State of California (Caltrans) Standard Specifications.

I. Unsuitable Material

The site may have soils unsuitable for use on the project. Soils containing organic matter, rubble, or rubbish, or found not suitable for fill, subgrade, or bioretention facilities by the engineer shall be removed from the site by the contractor. Attention is directed to Part 1, 1.01 G, "Export," of this section.

PART III: EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. On Site Storage: Store site soil and import soil material on-site covered or in a location where material will not be contaminated. Stockpiles of soil shall be covered with plastic or geotextile or protected with a linear sediment barrier at all times during the rainy season, and when precipitation is predicted during the non-rainy season.

3.02 LAYOUT AND PREPARATION

A. Lay out all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities—all prior to beginning actual earthwork operations.

3.03 CLEARING, STRIPPING, AND PREPARING PAVEMENT AREAS

A. All existing structures (including utilities) and associated backfill, pavements, landscaping, vegetation, debris, and other deleterious materials encountered during site work and deemed unacceptable by the Engineer, shall be removed and disposed of so as to leave the disturbed areas with a neat and finished appearance, free from unsightly debris. Excavations and depressions resulting from the removal of such items, as determined by the Engineer, shall be cleaned out to firm soils and backfilled with suitable materials in accordance with these specifications.

B. Within structural areas, all existing fill soils and/or loose, saturated materials shall be over-excavated to firm, undisturbed native soil, as determined by the Engineer, and the resulting excavations shall be backfilled with suitable materials in accordance with these specifications.

C. The surfaces receiving fill shall be stripped of vegetation; or, they shall be thoroughly disced provided that a compactable mixture of soil containing minor amounts of vegetation can be attained which is free of clumps, layers or pockets of vegetation. If proper compaction of the disturbed surface soils cannot be achieved, those materials shall be excavated, to a depth satisfactory to the Engineer, so that a firm base for support of engineered fill can be attained.

D. All fill to be constructed that will be below the depth of chemical treatment, if any, shall be constructed in accordance with Section 3.04 of these specifications and the surfaces receiving fill shall be prepared in accordance with the following paragraphs in this section.

E. Where saturated surface soils are located over native undisturbed soils, the subgrades may be stabilized with chemical treatment to depths and with compaction effort meeting the satisfaction of the Engineer.

F. If drying shrinkage (desiccation) cracking is present in the subgrade soils, prior to the commencement of fill construction or compaction of exposed subgrades, future construction areas shall be repeatedly watered for a period of not less than three days.
(assuming a dry, summer or fall construction period) and shall continue until the Engineer
determines that saturation of the subgrades has been adequate to close the shrinkage
cracks. The subgrades shall then be reworked by blading or discing to achieve a uniform
moisture content.

G. The surfaces upon which fill is to be placed shall be plowed or scarified to a depth of at
least twelve inches (12"), until the surface is free from ruts, hummocks or other uneven
features which would tend to prevent uniform compaction by the selected equipment.

H. When the moisture content of the subgrade is less than the optimum moisture content, as
defined by the ASTM D1557 Test Method, water shall be added until the proper moisture
content is achieved.

I. When the moisture content of the subgrade is too high to permit the specified compaction
to be achieved, the subgrade shall be aerated by blading or other methods until the
moisture content is satisfactory for compaction.

J. After the foundations for fill have been cleared, moisture conditioned, and plowed or
scarified, they shall be recompacted in place to a depth of at least twelve inches (12") to
a minimum of ninety percent (90%) of the ASTM D1557 Test Method maximum dry
density if these soils will not be lime stabilized.

K. The pavement areas shall be defined as extending at least two feet (2') beyond the
edges of pavement, where possible.

3.04 CONSTRUCTION OF UNTREATED SUBGRADES

A. The selected soil fill material shall be placed in layers which, when compacted, do not
exceed six inches (6") in thickness. Each layer shall be spread evenly and shall be
thoroughly mixed during the spreading to promote uniformity of material in each layer.

B. When the moisture content of the fill material is less than the optimum moisture, as
defined by the ASTM D1557 Test Method, water shall be added until the proper moisture
content is achieved.

C. When the moisture content of the fill material is too high to permit the specified degree of
compaction to be achieved, the fill material shall be aerated by blading or other methods until the
moisture content is satisfactory.

D. After each layer has been placed, mixed and spread evenly, it shall be thoroughly
compacted to not less than ninety percent (90%) of maximum dry density as determined
by the ASTM D1557 Test Method. Compaction shall be undertaken with equipment
capable of achieving the specified density and shall be accomplished while the fill
material is at the required moisture content. Each layer shall be compacted over its
entire area until the desired density has been obtained.

E. The fill operations shall be continued until the fills have been brought to the slopes and
grades shown on the Plans.

3.05 LIME-STABILIZED SUBGRADE CONSTRUCTION

A. Placing Material

The material to be treated shall be placed at a moisture content at least two percent (2%)
over optimum moisture as defined by the ASTM D1557 Test Method.

B. Preparing Material
Material to be treated shall be scarified and thoroughly broken up to the full depth and width to be stabilized. The material to be treated shall contain no rocks or solids larger than one and one-half inches (1\(\frac{1}{2}\)) in maximum dimension.

C. Mixing

1. Lime shall be spread by equipment that will uniformly distribute the required amount of lime 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.

2. The spread lime 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 ripped in, or mixed into, the soil the same day lime spreading operations are performed.

3. The distance which lime may be spread upon the prepared material ahead of the mixing operation will be determined by the Engineer.

4. No traffic other than the mixing equipment will be allowed to pass over the spread lime until after the completion of mixing.

5. Mixing equipment shall be equipped with a visual depth indicator showing mixing depth, an odometer or foot meter to indicate travel speed and a controllable water additive system for regulating water added to the mixture.

6. 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 or pockets of lime), moisture is at approximately two percent (2%) over optimum and the mixture complies with the following requirements:

<table>
<thead>
<tr>
<th>Minimumsievetest</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1&quot;</td>
<td>95</td>
</tr>
<tr>
<td>No. 4</td>
<td>60</td>
</tr>
</tbody>
</table>

7. 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.

8. Lime-treated material shall not be mixed or spread while the atmospheric temperature is below 35°F.

D. Spreading and Compacting

1. 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 Engineer that his equipment and method of operation will provide uniform distribution of the lime 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 Engineer, at no additional cost to the Owner.
2. The finished thickness of the lime-treated material shall not vary more than one-tenth foot (0.1') from the planned thickness at any point.

3. The lime-treated soils shall be compacted to a relative compaction of not less than ninety-five percent (95%) as determined by the ASTM D1557 Test Method.

4. Initial compaction shall be performed by means of a sheepsfoot or segmented wheel roller. Final rolling shall be by means of steel-tired or pneumatic-tired rollers.

5. Areas inaccessible to rollers shall be compacted to meet the minimum compaction requirement by other means satisfactory to the Engineer.

6. Final compaction shall be completed within thirty-six (36) hours of initial mixing. The surface of the finished lime-treated material shall be the grading plane and at any point shall not vary more than eight one hundredths of a foot (0.08') foot above or below the grade established by the Engineer except that when the lime-treated material is to be covered by material which is paid for by the cubic yard the surface of the finished lime-treated material shall not extend above the grade established by the Engineer.

7. 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. The trimmed and completed surface shall be rolled with steel or pneumatic-tired rollers. Minor indentations may remain in the surface of the finished material so long as no loose material remains in the indentations.

8. 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.

9. 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.

E. Curing

The surface of each compacted layer of lime-treated material shall be kept moist until covered by a subsequent layer of lime-treated or other material. The final layer of lime-treated material shall be kept moist for at least three (3) days after final trimming and rolling. No equipment or traffic shall be permitted on the lime-treated material during the first three (3) days of moist curing or after applying the curing seal.

3.06 CEMENT-STABILIZED SUBGRADE CONSTRUCTION

A. Placing Material

The chemically amended material shall be placed at a moisture content of at least the optimum moisture as defined by ASTM D1557.

B. Preparing Material

Material to be treated shall be scarified and thoroughly broken up to the full depth and width to be stabilized. The material to be treated shall contain no rocks or solids larger than three inches (3") in maximum dimension.
C. **Mixing**

1. Cement shall be spread by equipment that will uniformly distribute the required amount of 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.

2. The spread cement shall be prevented from blowing by suitable means selected by the Contractor. The spreading operations shall be conducted in such a manner that a hazard is not present to construction personnel or the public. All cement spread shall be thoroughly ripped in, or mixed into, the soil the same day cement spreading operations are performed.

3. The distance which cement may be spread upon the prepared material ahead of the mixing operation will be determined by the Engineer.

4. No traffic other than the mixing equipment will be allowed to pass over the spread cement until after the completion of mixing.

5. 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.

6. 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 or pockets of cement) and moisture is at approximately the optimum.

7. Cement-treated material shall not be mixed or spread while the atmospheric temperature is below 35°F. Not more than two (2) hours shall elapse between the time water is added to the subgrade and cement, and the time of completion of initial compaction prior to trimming.

D. **Spreading and Compacting**

1. 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 Engineer that his equipment and method of operation will provide uniform distribution of the 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 Engineer, at no additional cost to the Owner.

2. The finished thickness of the cement-treated material shall not vary more than one-tenth foot (0.1') from the planned thickness at any point.

3. The cement-treated soils shall be compacted to a relative compaction of not less than ninety-five percent (95%) as determined by ASTM D1557.

4. Initial compaction shall be performed by means of a sheepsfoot or segmented wheel roller. Final rolling shall be by means of steel-tired or pneumatic-tired rollers.

5. Areas inaccessible to rollers shall be compacted to meet the minimum compaction requirement by other means satisfactory to the Engineer.

6. The surface of the finished cement-treated material shall be the grading plane and at any point shall not vary more than eight one hundredths of a foot (0.08')
foot above or below the grade established by the Engineer except that when the cement-treated material is to be covered by material which is paid for by the cubic yard the surface of the finished cement-treated material shall not extend above the grade established by the Engineer.

7. 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. The trimmed and completed surface shall be rolled with steel or pneumatic-tired rollers. Minor indentations may remain in the surface of the finished material so long as no loose material remains in the indentation.

8. 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.

9. 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.

E. Curing

The surface of each compacted layer of cement-treated material shall be kept moist until covered by a subsequent layer of cement-treated or other material. The final layer of cement-treated material shall cured by application of a bituminous or other approved sealing membrane, or by being kept continuously moist for at least three (3) days after final trimming and rolling. If curing material is used, it shall be applied no later than twenty four (24) hours after completing finishing operations. No equipment or traffic shall be permitted on the cement-treated material during the first twenty-four (24) hours of moist curing or after applying the curing seal.

3.07 FINAL SUBGRADE PREPARATION USING UNTREATED SOILS
A. The upper six inches (6") of any untreated final pavement subgrades shall be uniformly compacted to at least ninety-five (95%) percent of the ASTM D1557 Test Method maximum dry density, at not less than the optimum moisture content.

3.08 TESTING AND OBSERVATION
A. All grading operations, including chemical-treatment of the subgrades, shall be tested and observed by the Engineer, serving as the representative of the Owner.

B. Field density tests shall be made by the Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread until the field density tests indicate that the minimum specified density has been obtained.

C. Earthwork shall not be performed without the notification or approval of the Engineer. The Contractor shall notify the 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 technical 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 Architect/Engineer. No deviations from the specifications shall be made except upon written approval of the Engineer or Architect/Engineer.

3.09 EXPORTED SOIL
A. The site may have soils unsuitable for use on the project. Soils containing organic matter, rubble, or rubbish, or found not suitable for fill, subgrade, or bioretention facilities by the Engineer shall be removed from the site by the contractor. Attention is directed to Part 1, 1.01 G, “Export, “of this section.

3.10 GEOGRID SEG\text{G}
A. Geogrid SEG\text{G} shall be placed in accordance with manufacturer's recommendations.

MEASUREMENT AND PAYMENT
The contract unit price paid per cubic yard of Roadway Excavation and Grading, the unit price paid per cubic yard of Import Soil, per square feet of Soil Stabilization, per square feet of Geogrid and per cubic yard of Export Soil, etc., shall include full compensation for furnishing all labor, materials, tools, hauling, unloading, equipment, excavation, placement, compaction and incidentals, and incidental, and for doing all the work involved as specified herein and for doing all work not specifically called out and conforming to the provisions of this section shall be included in the unit costs of the various items of work and no additional compensation shall be allowed.

Roadway Excavation and Grading - The bid item for Roadway Excavation and Grading shall include grading, placement and compaction for the import soil and for the suitable native material.

Import Soil – The bid item for Import Soil is for fill material conforming to the Special Provisions brought to the site.

*** END OF SECTION ***
SECTION 31-6000

TRENCHING, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work of this Section includes all earthwork required for construction of additions to the authorized agencies property. Such earthwork shall include, but not be limited to the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the Work specified in the Contract Documents. The Work shall also include the supporting of structures and utilities above and below the ground. All backfilling around structures and utilities and all backfilling of trenches and pits. The disposal of excess excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork, all in accordance with the requirements of the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

A. The CONTRACTOR’s attention is directed to the provisions of the California Code of Regulations, Title 8 “Industrial Relations”, DIVISION 1, Chapter 4, Subchapter 4 “Construction Safety Orders”, Article 6 “Excavations”; and Section 6705 of the California Labor code. In accordance with these requirements the CONTRACTOR shall submit for ENGINEER’s review a detailed plan of the provisions to be made for worker protection from the hazard of caving ground during excavation. The detailed plan shall include the name of the CONTRACTOR’s “competent person”, who shall be responsible for the safety of all persons entering excavations made under this Contract. Also included in the detailed plan shall be reference to the provisions of the Construction Safety Orders, and how the CONTRACTOR’s shoring plan meets the requirements of said document.

B. The CONTRACTOR shall inform the ENGINEER in writing if the designated “competent person” is to change during the Contract Period. The name and title of the replacement shall be provided.

1.03 QUALITY ASSURANCE

A. General: It shall be the responsibility of the CONTRACTOR to accomplish the specified compaction for backfill or other earthwork. All testing, re-testing, and related inspection tests, other than compliance testing performed by the governing agency, shall be contract work with all costs borne by the CONTRACTOR.

B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content shall be determined in accordance with ASTM D1557. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density shall be determined in accordance with ASTM D4253 and D4254. Field density in-place tests shall be performed in accordance with ASTM D1556, ASTM D2922, or by such other means acceptable to the ENGINEER.

C. In case the tests of the fill or backfill show non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to ensure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the AUTHORIZED AGENT of the Owner and shall be at the CONTRACTOR’s expense.
D. Particle size analysis of soils and aggregates shall be performed using ASTM D422.
E. Determination of sand equivalent value shall be performed using ASTM D2419.
F. The determination of durability index shall be made using ASTM D3744.
G. The determination of the resistance (R-Value) shall be made using ASTM D2844 or California Test Method No. 31, State of California, Department of Transportation.

PART 2  PRODUCTS

2.01 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General. Fill and backfill materials shall be suitable selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other vegetation, and with a maximum particle size of 4 inches.
B. Fill and backfill materials to be placed within 6 inches of any structure shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 2 inches.
C. Fill and backfill materials to be placed within 12 inches of a pipe or conduit shall be as specified on the plans.
D. Suitable materials may be obtained from onsite excavations, may be processed from onsite materials, or may be imported. If imported materials are required to meet the requirements of this Section or to meet the quantity requirements of the project, then the CONTRACTOR shall provide the imported materials at no additional expense to the AUTHORIZED AGENT of the Owner. The CONTRACTOR shall designate the proposed import sources in advance and shall provide representative source samples to be tested prior to acceptance and use.

2.02 SUITABLE MATERIALS

A. Non-Engineered Fill.
   1. Native soils, excluding topsoil and fill soil as identified in the geotechnical report, may be acceptable as non-engineered fill.
   2. Native soils must be free of organics, clean of deleterious materials, and evaluated as to their engineering properties (e.g., expansion potential and strength) by a qualified geotechnical engineer prior to acceptance for use during actual earthwork.
B. Imported Fill
   1. Import fill shall be free of organic and artificial debris, and meet the specifications as detailed in the Geotechnical Investigation
   2. The CONTRACTOR shall designate the proposed import source in advance and provide source samples to be tested prior to acceptance and use.
C. Aggregate Base and Subbase.
1. Class 2 Aggregate Base shall be as specified in Caltrans standard Specifications, Section 26-1.02A, 3/4 inch maximum.

2. Class 2 Aggregate Subbase shall be as specified Caltrans Standard Specifications, Section 25-1.02A class 2.

D. Pipe Bedding Material.

1. Coarse pipe bedding shall be Class 2 Aggregate Base per Paragraph C. 1.

2. Bedding material for poly-wrapped DIP pipe shall be sand as defined below.

E. Sand Backfill.

1. Sand backfill shall be free of organics and other deleterious materials.

2. Sand backfill shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4</td>
<td>90-100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-5</td>
</tr>
</tbody>
</table>

F. Coarse Bedding

1. Coarse Bedding shall consist of clean, durable, crushed (i.e., angular) aggregate, uniformly graded within the gradation requirements below.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch</td>
<td>100</td>
</tr>
<tr>
<td>1 ½ -inch</td>
<td>90-100</td>
</tr>
<tr>
<td>3/4 - inch</td>
<td>5-30</td>
</tr>
<tr>
<td>3/8 - inch</td>
<td>0-5</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-2</td>
</tr>
</tbody>
</table>

G. Geotextile Fabric.

1. Any geotextile fabric should be non-woven consisting of polymeric filaments formed into a stable network. The fabric should be inert to commonly encountered chemicals, rot-proof and resistant to ultra-violet light exposures, insects, and rodents. All fabric shall be submitted to the AUTHORIZED AGENT of the Owner for approval prior to any use.

2.03 UNSUITABLE MATERIAL

A. Unsuitable soils for fill material shall include, but not be limited to, all soils which, when classified under ASTM D2487, fall in the classifications of Pt, OH, CH, MH, or OL.

B. In addition, any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use, shall be classed as unsuitable material.

2.04 USE OF FILL AND BACKFILL MATERIAL TYPES

A. The CONTRACTOR shall use the types of materials as designated herein for all required
fill and backfill hereunder.

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction, or with the requirements of a material manufacturer, the ENGINEER shall be immediately notified. In case of conflict therewith, the CONTRACTOR shall use the most stringent requirement, as determined by the ENGINEER.

C. Fill and backfill types shall be used in accordance with the following provisions:

1. Pipe zone backfill, as defined under “Pipe and Utility Trench Backfill” herein, shall consist of Pipe Bedding material.

2. Trench zone backfill for pipelines as defined under “Pipe and Utility Trench Backfill” shall be Aggregate Base material.

3. Final backfill material for pipelines under paved areas, as defined under “Pipe and Utility Trench Backfill” shall be Aggregate base material up to the pavement base. Pavement base and pavement material shall be as defined in Section 32 12 16, Hot Mix Asphalt. Final backfill under areas not paved shall be the same material as that used for trench backfill, except that top soil material shall be used for final 8 inches of backfill in landscape areas unless otherwise shown or specified.

4. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.

5. Aggregate base materials under pavements shall be Aggregate Base material constructed to the thicknesses shown or specified.

6. Backfill around structures shall be Class 2 Aggregate Base material or imported engineered fill.

7. Backfill used to replace pipeline trench over-excavation shall be a layer of Coarse Bedding material wrapped in filter fabric to prevent migration of fines for wet conditions.

8. Backfill used in areas of over-excavation, areas where excavation bottoms are disturbed, or areas where the excavation bottom is or becomes unstable shall be course bedding wrapped in geotextile fabric.

PART 3 EXECUTION

3.01 Pavement Subgrade

A. All areas to be under pavements and concrete flatwork (e.g., roadway, sidewalks), or which will otherwise receive engineered fill should be stripped of organics (e.g., topsoil), tree or shrubbery roots, existing fill, and any other man-made materials. See boring logs in referenced Geotechnical Soils Report for approximate depths of fill and topsoil at the boring sites.
B. The top 6-inches of subgrade soils beneath pavement areas shall be compacted to a minimum relative compaction of 95 percent of maximum dry density by ASTM D1557.

C. The surface of the subgrade after compaction shall be hard, uniform, smooth, and true to grade and cross-section. Subgrade shall not vary more than 0.05 foot from specified grade and cross-section.

3.02 STRUCTURE AND ROADWAY

A. General.

1. The CONTRACTOR shall submit a trenching plan for review before any trench excavation commences. Trenches in areas of pedestrian or vehicular traffic shall be open the minimum time necessary to complete the work, but shall not exceed 4 days maximum before backfilling trench. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the Work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

2. Except where otherwise specified, indicated on the Drawings, or accepted in writing by the ENGINEER, the maximum length of open trench, as defined in this paragraph and below, where the construction is in any stage of completion, shall not exceed the linear footages as set forth in the following. The definition of “open trench” for the purposes of this description will include excavation, pipe laying, backfilling, and temporary pavement replacement. Any excavated areas shall be considered as “open trench” until all temporary pavement has been backfilled and compacted in accordance with these Contract Documents. Trenches across streets shall be completely backfilled with temporary or permanent pavement in place as soon as possible after pipe laying.

B. Excavation Beneath Paved Areas. Excavation under areas to be paved shall extend to the bottom of the aggregate base, if such base is called for; or as otherwise called out in the specifications, otherwise it shall extend to the paving thickness. After the required excavation has been completed, the exposed surface shall be scarified, worked and compacted to obtain the Relative Compaction required for the area as stated on the plans or the specifications.

C. Steel Plates. Steel plates of 1-inch minimum thickness with adequate trench bracing shall be used to bridge across trenches at streets and driveways and where trench backfill and temporary patch have not been completed during regular working hours. Safe and convenient passage for pedestrians shall be provided. The ENGINEER may designate a passage to be provided at any point deemed necessary. Access to fire stations, fire hydrant, and hospitals shall be maintained at all times. Comply with latest Caltrans requirements.

D. Stockpiling of excavated material overnight along the trench in business, commercial, or
3.03 PIPELINE AND UTILITY TRENCH EXCAVATION

A. General. Unless otherwise shown or ordered, excavation for pipelines and utilities shall be vertical trenches.

B. Excavation and backfill shall conform to the provisions in Section 19-3, Caltrans Standard Specifications. Backfill around waterlines protected with polyethylene wrap shall be in accordance with the manufacturer's recommendations and shall be fine sand material placed to a minimum of twelve inches above top of pipe. All backfill material shall be approved by the Engineer.

C. Trenches may be excavated either by hand, or by machine; and excavation shall begin at the outlet end and proceed upgrade. Trenches shall be in accordance to the California Division of Safety and Health Construction Safety Orders.

D. Trench Bottom. The bottom of the trench shall be excavated uniformly. Where bell and spigot pipe is used, excavation shall accommodate bell. The trench bottom shall be given a final trim, using a laser to set the string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required.

E. Open Trench. The maximum lengths of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trench excavations shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic. In those locations where it is impractical to either backfill or install steel plates at the end of the day, the CONTRACTOR shall submit a non-working -hour traffic control and barricade plan in accordance with OSHA regulations.

F. Trench Over-Excavation. Where the Drawings indicate that trenches shall be over-excavated, they shall be excavated to the depth shown, and then backfilled with coarse bedding material wrapped in geotextile fabric to the grade of the bottom of the bedding.

G. Over-Excavation. When ordered by the ENGINEER, where indicated on the Drawings or not, trenches shall be over-excavated beyond the depth shown. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the bedding. All work specified in this Section shall be performed by the CONTRACTOR at his cost when the over-excavation ordered by the ENGINEER is less than 6 inches below the limits shown. When the over-excavation ordered by the ENGINEER is 6 inches or greater below the limits shown, additional payment will be made to the CONTRACTOR for that portion of the Work which is located below said 6-inch distance. Said additional payment will be made under separate unit price bid items for over-excavation and bedding if such bid items have been established; otherwise payment will be made in accordance with a negotiated price.

H. Where a trench has been excavated below the designed grade, the bottom of the trench shall be refilled with approved material, well compacted in place in an approved manner and to the satisfaction of the Geotechnical Consultant. This shall be done at no additional cost to the Owner.
I. Where pipelines are to be installed in embankment or structure fills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

J. The Owner shall have the right to limit the amount of trench that is opened or partially opened at any one time; and also to limit the amount of trench left without backfill, at any one time.

3.04 OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN

A. If the bottom of the excavation is found to consist of soft or unstable material which is incapable of properly supporting the pipe, the ENGINEER shall be advised immediately. At the ENGINEER’s direction, such material shall be removed to the depth and for the lengths specified and the trench refilled to grade with coarse bedding material wrapped in geotextile fabric.

B. The CONTRACTOR shall obtain the ENGINEER’s written approval prior to over-excavating. Any over-excavating without such approval shall be at the CONTRACTOR’s expense. The quantity of approved unsuitable material excavated and its replacement with coarse bedding material wrapped in geotextile fabric shall be paid for as extra work.

C. Where the Contractor, in excavating trenches, exceeds the widths specified above, he shall furnish at his own expense, higher strength pipe, or other methods of construction as approved by the Engineer, to adequately provide for the increased loading, which the trench widening will cause.

3.05 EXCAVATION IN VICINITY OF TREES

A. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the Owner. Trees shall be supported during excavation by any means previously reviewed by the ENGINEER. Provide temporary fencing around trees.

3.06 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. The CONTRACTOR shall remove and stockpile all excess excavated material.

3.07 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

B. Except for coarse bedding materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation.

3.08 PLACING AND SPREADING OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in layers, loose depth 6 inches or
During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted, the pipe zone backfill will provide uniform bearing and side support.

C. Where the backfill material moisture content is too low to permit the specified degree of compaction, water shall be added before or during spreading until the proper moisture content is achieved. Jetting will not be permitted for compaction.

D. Where the backfill material moisture content is too high to permit the specified degree of compaction, the material shall be dried until the moisture content is satisfactory.

### 3.09 COMPACTION OF FILL AND BACKFILL

A. Each layer of backfill materials as defined herein, where the material is graded such that at least 10 percent passes a No. 4 sieve, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content. Lightweight mechanical tampers or vibrating plate compactors shall be used in pipeline and utility trenches to prevent damage to existing or new utilities.

B. Compaction of backfill adjacent to all subgrade structure walls shall follow a pattern of compaction which begins at the wall face and progresses outward to the outside edge of the excavation before beginning a new lift.

C. Coarse pipe bedding material shall be compacted by means of at least 2 passes from a flat plate vibratory compactor.

D. Flooding, ponding, or jetting shall not be used.

E. Equipment weighting more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

F. Compaction Requirements. The compaction test requirements shall be in accordance with the geotechnical report or ASTM D1557 or in accordance with ASTM D4253 and D4254 as applicable. Where outside agency or utility company requirements govern, the highest compaction standards shall apply.

G. Trench Backfill Requirements. The pipe has been structurally designed based upon the trench configuration shown in the Drawings. Where pipe embedment is disturbed after compaction, such as by the removal of sheeting and shoring, AUTHORIZED AGENT of the Owner may require recompaction to the specified minimum limit. Recompaction work shall be done in accordance with California “Construction Safety Orders” and Federal OSHA requirements, and the Contract Documents.

H. If the allowable deflection specified for the pipe is exceeded, the CONTRACTOR shall expose and replace the pipe, repair all damaged lining and coating, and reinstall the pipe zone material and trench backfill as specified at no additional expense to the Owner.
3.10 PIPE AND UTILITY TRENCH BACKFILL

A. Pipe Zone Backfill. The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe, i.e., the trench subgrade, and a plane at a point 12 inches above the top surface of the pipe. The bedding is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe.

B. Bedding shall be provided for all sewers, water mains, and drainage pipelines. Unless otherwise specified or shown, for other pipelines the bedding may be omitted if all the following conditions exist.
   1. The pipe bears on firm, undisturbed native soil which contains only particles that will pass a one-inch sieve.
   2. The trench excavation is not through rock or stones.
   3. The trench subgrade soils are classified as suitable fill and backfill materials per this Specification.
   4. The trench subgrade soils have, as a maximum, a moisture content that allows compaction.
   5. Pipe diameters less than 3 inches.

C. Where bedding is required, after compacting the bedding, the CONTRACTOR shall perform a final trim using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe.

D. The pipe zone shall be backfilled with the specified backfill material as shown in the civil project plans. The CONTRACTOR shall exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.

E. Trench Zone Backfill. After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade. If the trench is under pavement, the upper plane is 18 inches below the roadway subgrade.

F. Final Backfill. Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway subgrade.

G. Periodic compliance tests may be made by the ENGINEER at no cost to the CONTRACTOR to verify that compaction is meeting the specified requirements.

H. If compaction fails to meet the specified requirements, the CONTRACTOR shall remove and replace the backfill at proper compaction or shall increase the compaction to specified level by other means acceptable to the ENGINEER. Subsequent tests required to verify that the reconstructed backfill meets the specified compaction shall be paid by the CONTRACTOR.
3.11 EMBANKMENT CONSTRUCTION

A. The area where an embankment is to be constructed shall be cleared of all vegetation, roots and foreign material. Following this, the surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted to 95 percent of maximum density under structures and paved areas, and 90 percent of maximum density elsewhere.

B. Where embankment or structure fills are constructed over pipelines, the first 4 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe.

3.12 DISPOSAL OF SURPLUS MATERIAL

A. Remove unsuitable materials and debris from the site and dispose of it in a legal manner. Location of disposal site and length of the haul shall be the CONTRACTOR’s responsibility.

END OF DOCUMENT
SECTION 32 11 00
AGGREGATE BASE

PART I - GENERAL
1.01 DESCRIPTION
A. This section covers the aggregate base for all roadway section, concrete sidewalks, and HMA walkways.
B. Aggregate bases shall conform to Section 26, "Aggregate Bases," of the Standard Specifications and these special provisions.
C. The work to be performed includes the preparation of the aggregate base course, the production, stockpiling, transporting, placing, compacting of the aggregate base course and all other required incidental work.

1.02 SUBMITTALS
A. Contractor shall submit aggregate base source and certified laboratory test results to the Engineer for approval.
B. Contractor shall submit tickets for each load of aggregate.

PART 2 – PRODUCTS
2.01 DESCRIPTION
A. Aggregate base shall be Class 2 with ¾ inch maximum aggregate and conform to Section 26.1.02B of the Standard Specifications.

PART 3 – EXECUTION
3.01 DELIVERY, STORAGE, AND HANDLING
A. On Site Storage: Store aggregate-base material on-site covered or in a location where material will not be contaminated. Stockpiles of aggregate base shall be covered with plastic or geotextile, or protected with a linear sediment barrier at all times during the rainy season, and when precipitation is predicted during the non-rainy season.

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

3.03 PLACEMENT AND COMPACTION
A. Subgrade shall be prepared and compacted per Section 19 and 26 of the Standard Specifications and the provisions in Section 3030 – Earthwork of the Special Provisions.
B. Spreading and compactions of Aggregate base shall conform to Section 26 of the Standard Specifications. Aggregate base thickness more than 0.5 foot, shall be spread and compacted in two (2) or more layers approximately equal in thickness. Compact each layer to at least 95% relative compaction under California Test 231.

MEASUREMENT AND PAYMENT

The contract unit price paid per ton of Aggregate Base shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved as specified herein and conforming to the provisions of this section and no additional compensation will be allowed therefore.

END OF SECTION
SECTION 32 12 16
HOT MIX ASPHALT

PART I - GENERAL

1.01 DESCRIPTION
A. This section applies to all hot mix asphalt (HMA) for the road pavement section.
B. Hot mix asphalt shall conform to Section 39, “Asphalt Concrete,” of the Standard Specifications and these special provisions.
C. Asphalt Concrete (AC) and HMA may be used interchangeably on the plans and specifications.
D. The work to be performed includes the preparation of the aggregate base course, application of tack coat, the production, transporting, placing, compacting of the HMA and all other required incidental work.

1.02 SUBMITTALS
A. Contractor shall submit HMA source and mix design prepared by a certified laboratory to the Engineer for review and approval.
B. Accompanying mix design, submit materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceed, specified requirements.
C. Contractor shall submit tickets for each load of asphalt concrete.
D. Submit certificate of compliance for tack coat per Section 94, "Asphaltic Emulsion," of the Standard Specifications.

PART 2 – PRODUCTS

2.01 DESCRIPTION
A. HMA
   1. HMA for the road pavement section shall be Type B, placed at least in two layers, ½ inch maximum aggregate for the final layer and ¾ inch maximum aggregate for the bottom layer.
   2. HMA for the walkways shall be Type B, ½ inch maximum aggregate.
B. Asphalt Binder shall be Steam-refined paving asphalt Grade PG 64-10 per Section 92 of the Standard Specifications.
C. Tack Coat shall be applied to the finished surfaces of the aggregate base prior to placement of the HMA, between HMA layers, and to vertical surfaces of curbs, gutters, construction joints per Section 39-1.09C. Tack Coat shall be slow setting asphalt emulsion SS1h per Section 94, "Asphaltic Emulsion," of the Standard Specifications.

PART 3 – EXECUTION
3.01 PLACEMENT

A. HMA

1. Placement of HMA shall be in accordance with Section 39 of the Standard Specifications.

2. A tack coat treatment shall be applied to finished surfaces of aggregate and concrete surfaces where HMA will meet and shall be applied per Section 39-1.09 of the Standard Specifications.

3. Total HMA thickness shall be as specified on the plans.

MEASUREMENT AND PAYMENT

The contract unit price paid per ton of Hot Mix Asphalt shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in mobilization as specified herein and conforming to the provisions of this section and no additional compensation will be allowed therefore.

Tack Coat will be included in the cost of HMA and no additional compensation will be allowed.

END OF SECTION
SECTION 32 17 23

PAVEMENT MARKINGS AND STRIPING

PART I - GENERAL

1.01 DESCRIPTION

A. This section shall apply to all pavement markings and striping.
B. Refer to Section 84 TRAFFIC STRIPES AND PAVEMENT MARKINGS of the Caltrans Standard Specifications for all pavement markings and striping.

PART 2 – PRODUCTS

1.01 DESCRIPTION

A. All pavement markings and striping shall be painted.
B. Paint material and color shall conform to Section 84-3.02 of the Caltrans Standard Specifications and shall include glass beads.

PART 3 – EXECUTION

2.01 PLACEMENT

A. All applications shall utilize the two-coat application method and rates in accordance with Section 84-3.03 of the Caltrans Standard Specification.

MEASUREMENT AND PAYMENT

The contract unit price paid for bid items Pavement Markings, Striping and Signage shall include all cost for furnishing all labor, reinforcement and appurtenant materials, tools, equipment and incidentals, and for doing all the work involved in execution as specified herein and conforming to the provisions of this section and no additional compensation will be allowed therefore.

END OF SECTION
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SECTION 32-4000
CURB, GUTTER AND SIDEWALKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers the work necessary to construct the monolithic curb, gutter and sidewalk, complete, as shown on the Drawings and specified herein.

1.02 CONTRACTOR SUBMITTALS

A. Submit complete information regarding mix to the ENGINEER

B. If a curb and gutter machine is to be used to do the Work, submit information for approval by the ENGINEER.

C. If metal forms are to be used to do the Work, submit information for approval by the ENGINEER.

PART 2 - PRODUCTS

2.01 CONCRETE

A. Concrete shall be as specified in plans and Caltrans Standard Specifications (CSS).

2.02 REINFORCING STEEL

A. Reinforcing steel shall be as specified in plans and CSS.

2.03 CURING COMPOUND

A. Liquid membrane-forming curing compound shall be clear or translucent, suitable for spray application and shall conform to ASTM C309, Type 1.

2.04 FORMS

A. Materials for the monolithic sidewalk forms shall be 2-inches dressed dimension lumber or metal of equal strength, free from defects which would impair the appearance or structural quality of the completed structure. Where short radius forms are required, 1-inch dressed lumber or plywood may be used. Provide stakes and bracing materials as required to hold forms securely in place.

B. Forms shall not vary from vertical grade by more than 0.02 feet and from horizontal alignment by more than 0.05 feet within the distance not to exceed 25 feet at each occurrence. Unnecessary meandering of the alignment line shall be sufficient cause for rejection and removal. All forms shall have smooth even lines in both the horizontal and vertical plane.
2.05  BASE
   A. Material shall conform to Class 2 Aggregate Base as specified in CSS.

2.06  EXPANSION JOINT FILLER
   A. Expansion joint filler shall be preformed asphalt-impregnated, expansion joint material,
      confirming to ASTM D994.

PART 3 - EXECUTION

3.01  PREPARATION OF SUBGRADE
   A. Bring the areas on which monolithic sidewalk, curb and gutters are to be constructed to
      required grade. The top of subgrade soils shall be compacted as specified in Section 31
      23 33, Excavation, Backfill, and Compaction, for soils beneath pavement areas.

3.02  PLACING AGGREGATE BASE
   A. Place aggregate base to depth shown on the Drawings. Sprinkle with water and compact
      by rolling or other method. The top of the compacted gravel shall be at the proper level to
      receive the concrete.

3.03  SETTING THE FORMS
   A. Construct forms to the shape, lines, grades, and dimensions called for on the Drawings. Stake
      wood or steel forms securely in place, true to line and grade.
   B. Forms on the face of the monolithic sidewalk shall not have any horizontal joints within 7-
      inches of the top of the curb. Brace forms to prevent change of shape of movement in
      any direction resulting from the weight of the concrete during placement. Construct short
      radius curved forms to exact radius. Tops of forms shall not depart from grade lines more
      than 1/8-inch in 10 feet.

3.04  SIDEWALK CONSTRUCTION
   A. Construct the monolithic sidewalk to the line and grade shown or established by the
      ENGINEER.
   B. The subgrade and forms shall be wet immediately in advance of placing concrete.
   C. Place expansion joints at intervals not to exceed 60 feet and at the beginning and end of
      curb returns.
   D. Place weakened plane joints in the monolithic sidewalk at intervals not exceeding 10 feet.
      Weakened plane joints shall be ¼ inch wide by 1 inch deep in curbs and in sidewalks.
      Place score marks ¼ inch wide by ¼ inch deep on sidewalks between weakened plane
      joints or as shown on the architectural plans.
   E. As soon as the concrete has set sufficiently to support its own weight, remove the front
      form and finish all exposed surfaces. Broom finish sidewalks at right angles to the street.
Broom finish curb and gutter parallel to the street. Finish shall have a uniformly textured surface, free of marks, honeycomb, and other defects. All defective concrete shall be removed and replaced at the CONTRACTOR’S sole expense. Upon completion of the finishing, apply an approved curing compound to exposed surfaces. Curing shall continue for a minimum of 5 days.

F. Finished monolithic sidewalk shall present a uniform appearance for both grade and alignment. Remove any section of monolithic sidewalk showing abrupt changes in alignment or grade, or which is more than ¼ inch away from its location as staked, and reconstruct at the CONTRACTOR’s sole expense.

END OF SECTION
SECTION 33 33 40

STORM DRAIN FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section applies to all storm drain facilities, including storm drain pipe, culvert pipe, storm drain inlets, storm drain manholes, rock slope and channel protection (rip-rap), drain rock and appurtenances.

B. The storm drain facility service provider is City of Rohnert Park. All installation of storm facilities shall be inspected and approved by the Geotechnical Engineer.

C. The Contractor shall provide all materials, equipment and labor necessary to furnish and install storm drain pipes, manholes, inlets, culvert with flared end sections and headwall/wingwall, rip-rap and with all necessary fittings and coupling systems, including pothole and locating crossings at the existing PGE main, excavation and backfill of the trench and all appurtenant work, complete, tested and operable, including all connections as shown on the Plans and as specified here.

D. Relevant specification includes but not be limited to Sections 51, 52, 61, 64, 65, of the Caltrans Standard Specifications, the City of Rohnert Park Engineering Standard Plans and Specifications and the Special Provisions.

E. Contractor shall obtain the most current City of Rohnert Park Engineering Standard Plans and Specifications prior to start of construction.


1.02 SUBMITTALS

A. Contractor shall submit Storm Drain Facilities material submittal to the Engineer for review and approval.

B. Contractor shall submit material certification stating conformance with the requirements of this section.

C. Details for the culvert headwall/wingwall.

D. Results of Air Test, CCTV Inspection.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Storm Drain Pipe - RCP

1. Reinforced Concrete Pipe shall be in accordance with Section 65-1 of the Caltrans Standard Specifications.

2. Pipe sizes shall be as shown on the plans and meet the minimum allowable classes specified below.

3. Minimum allowable classes of reinforced pipe:

<table>
<thead>
<tr>
<th>Cover in Feet</th>
<th>Minimum Class RCP</th>
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Sonoma County Office of Education Portable Building
| Less than 2.5 | CL V (3000 D) |
| 2.5-7.9 | CL III (1500 D) |
| 8.0-11.9 | CL IV (2000 D) |
| 12.0-17.0 | CL V (3000 D) |

4. Reinforced storm drain pipe 12-inches in diameter or greater shall be RCP Class III (1500 D) or higher.

**B. Storm Drain Inlets**

1. Storm drain inlets and frames in the bioretention basin shall be as shown on the plans.
2. Storm drain inlets and frames outside the roadway shall be as shown on the plans.

**C. Storm Drain Manholes**

1. Storm drain manholes shall be 48-inch Standard Precast Manhole per City of Rohnert Park Standard.
2. Standard Manhole Frame and Cover shall be per City of Rohnert Park Standard.

**D. Culvert Pipe**

1. Pipe shall be in accordance with Section 65 of the Caltrans Standard Specifications and as shown in the plans and as specified here.

**E. Rip Rap (Rock channel and slope protection)** shall be two layers of angular stone approximately 10 inch to 14 inch in size meeting the requirement of Class No. 1 and material properties for Method B placement and shall comply with Section 72-2 of the Caltrans Standard Specifications.

**F. Concrete Flared Ends** shall be Caltrans Standard Plan D-94 B and in accordance with Section 51 Concrete Structure of the Standard Specifications.

**G. Headwalls/Wings walls construction** shall be per Caltrans Standard Plan D-90, modified for a 48 inch RCP and in accordance with Section 51, Concrete Structure of the Standard Specifications. Submit detail for Engineer’s approval.

**PART 3 -EXECUTION**

**3.01 PLACEMENT**

A. Excavation, trenching and shoring shall be in accordance with Occupational Safety & Health Administration (OSHA) and Section 2600, “Sheeting, Shoring and Bracing”.

B. Trench excavation, bedding and backfill shall be in accordance with the City of Rohnert Park Standard Trench Detail and as modified herein:

1. Trench backfill above the import fill bedding trench section shown on P-10 and below the subgrade shall be native soil meeting the requirements of the Earthwork sections of the Special Provisions and compacted to 90% Relative Compaction up to the roadway subgrade.

2. If import fill is required for trench backfill it shall be paid under the Import Fill Bid Item. Excavation, backfill and compaction and all other required work shall be paid under the various Storm drain Bid Items.
3. Unsuitable soil or surplus soil shall be off hauled by the contractor.

C. Storm Drain Pipe
   1. Storm drain pipe shall be placed in accordance with Caltrans Standard Specifications, Section 64-1.03 for Plastic Pipe and Section 65-2.03 for Reinforced Concrete Pipe and as shown on the plans and as specified in the Special Provision.

D. Storm drain inlets shall be constructed in accordance with Section 51-7 Minor Structures of the Caltrans Standard Specifications and the City of Rohnert Park Standard Plans and Specifications.

E. Storm drain manholes shall be constructed in accordance with Section 65-1.04, City of Rohnert Park Engineering Standard Plans and Specifications.

F. Culvert Pipe
   1. Culvert pipe shall be constructed in accordance with Section 65-2.03 of the Caltrans Standard Specifications and as shown in the plans and as specified in the Special Provision.
   2. The scope of work shall include excavation, installation of culvert pipe, headwall/wingwall, flare end, placement of rip-rap and appurtenances at the delineated wetlands area shown in the plans.
   3. Fill slopes associated with this culvert will be no greater than 2:1, back filled with native soil. Exposed, back filled soil left after construction will be protected with hydromulch and plant materials.

G. Rip Rap (Rock Slope and Channel Protection) placement shall be in two (2) layers per Placement Method B in accordance with Section 72-2.03C of the Caltrans Standard Specifications.

H. Concrete Flared Ends shall be Caltrans Standard Plan D-94 B and in accordance with Section 51, “Concrete Structure,” of the Standard Specifications.

I. Headwalls/Wings walls construction shall be per Caltrans Standard Plan D-90 and in accordance with Section 51, “Concrete Structure,” of the Standard Specifications.

3.01 TESTING AND CLEANING

A. Storm drain facilities shall be tested in accordance with City of Rohnert Park Engineering Standard Plans and Specifications.

B. Contractor shall perform all required testing including Air Test, and CCTV Inspection.

C. Cleaning shall be in accordance with City of Rohnert Park Engineering Standard Plans and Specifications.

D. Air Pressure Test shall be per City of Rohnert Park Engineering Standard Plans and Specifications.

E. Television (CCTV) Inspection shall be in accordance with City of Rohnert Park Engineering Standard Plans and Specifications.

F. Notify Engineer 48 hours prior to scheduling testing.

G. Contractor is responsible for correcting any deficiencies at contractor’s expense.

MEASUREMENT AND PAYMENT
The contract unit price paid per liner feet of storm drain, the unit price paid per each storm drain manhole, storm drain inlet, and flared end section, the unit price paid per square foot of rip rap, and the lump sum price for the headwall/wingwall, etc. shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in installing the storm drain facilities as shown on the plans and specified herein and conforming to the provisions of this section and no additional compensation will be allowed therefore.

All excavation, backfill, imported fine material for bedding, cleaning and testing, and all other appurtenances and incidental work not specifically called out shall be included in the bid items costs of the sewer facilities and no additional compensation shall be allowed.

Import soil will be paid for under Import Fill Bid Item.

Export soil will be paid under Export Soil Bid Item.