

### PALOMAR COLLEGE -NORTH EDUCATION CENTER -PHASE 2 SITE WORK

PROJECT NO. 5015019-102// 10.06.2017

PALOMAR COMMUNITY COLLEGE

35090 Horse Ranch Creek Road Fallbrook, CA 92028



# PALOMAR COLLEGE - NORTH EDUCATION CENTER INTERIM VILLAGE - PHASE 2 SITE WORK FALLBROOK, CA

September 11, 2017 HMC # 5015019-102

HMC ARCHITECTS Architect
MASSON & ASSOCIATES ENGINEERING Civil Engineering
PS2 ENGINEERING, INC. Mechanical/Plumbing/Fire Protection/Low Voltage Engineers
ELECTRICAL/FIRE ALARM ENGINEERS, INC. JCE, Inc.

DPA, Inc. LANDSCAPE



#### TABLE OF CONTENTS

#### DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

PROVIDED BY OWNER

**DIVISION 01 - GENERAL REQUIREMENTS** 

PROVIDED BY OWNER

**DIVISION 10 - SPECIALTIES** 

SECTION 10 14 53 - PARKING AREA SIGNS

**DIVISION 12 - FURNISHINGS** 

SECTION 12 93 00 - SITE FURNISHINGS

#### **DIVISION 26 - ELECTRICAL**

SECTION 26 01 00 - GENERAL PROVISIONS

SECTION 26 05 19 - POWER CONDUCTORS

SECTION 26 05 26 - GROUNDING

SECTION 26 05 33 - CONDUIT AND FITTINGS

SECTION 26 05 34 - OUTLET AND JUNCTION BOXES

SECTION 26 05 43 - UNDERGROUND PULL BOXES AND MANHOLES

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

SECTION 26 09 24 - TIME CLOCKS

SECTION 26 22 13 - DRY TYPE TRANSFORMERS

SECTION 26 24 13 - SWITCHBOARD

SECTION 26 24 16 - PANELBOARDS

SECTION 26 27 13 - METER PEDESTALS

SECTION 26 27 26 - SWITCHES AND RECEPTACLES

SECTION 26 28 16 - DISCONNECTS

SECTION 26 51 14 - LED LIGHTING FIXTURES AND LAMPS

SECTION 26 90 90 - TESTING

#### **DIVISION 27 - COMMUNICATIONS**

SECTION 27 05 00 - REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

SECTION 27 05 33 - CONDUIT AND BOXES FOR COMMUNICATIONS

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS

SECTION 27 11 19 - TERMINATION BLOCKS PATCH PANELS

SECTION 27 13 23 – OPTICAL FIBER BACKBONE CABLING

SECTION 27 15 43 - FACEPLATES AND CONNECTORS

SECTION 27 16 19 - COMMUNICATIONS PATCH CORDS



#### DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 28 20 00 - VIDEO SURVEILLANCE SYSTEM

#### **DIVISION 31 - EARTHWORK**

SECTION 31 10 00 – GREEN SITE CLEARING SECTION 31 22 00.10 – EARTHWORK SECTION 31 22 01 – LANDSCAPE FINISH GRADING SECTION 31 23 15 – EARTHWORK - PORTABLES SECTION 31 23 16 – EXCAVATION SECTION 31 23 17 – TRENCHING SECTION 31 23 19 – DEWATERING SECTION 31 23 23 – BACKFILLING SECTION 21 23 26 – STABILIZED SUBSURFACE BASE

#### **DIVISION 32 - EXTERIOR IMPROVEMENTS**

SECTION 32 12 16 – ASPHALTIC CONCRETE PAVING
SECTION 32 12 17 – ASPHALTIC CONCRETE RAMPS
SECTION 32 12 43 – STABILIZED DECOMPOSED GRANITE PAVING
SECTION 32 13 13 – SITEWORK CONCRETE
SECTION 32 13 14 – PORTLAND CEMENT CONCRETE PAVING
SECTION 32 13 14 – PORTLAND CEMENT CONCRETE PAVING
SECTION 32 13 14.10 – PERVIOUS CONCRETE PAVEMENT
SECTION 32 14 13 – PRECAST UNIT PAVERS
SECTION 32 17 23 - PAVEMENT MARKING
SECTION 32 17 26 - TACTILE/DETECTABLE WARNING SURFACE TILE
SECTION 32 31 13 - FENCES AND GATES
SECTION 32 32 23 – SEGMENTED BLOCK RETAINING WALL
SECTION 32 93 00 – TREES, PLANTS AND GROUND COVERS

#### **DIVISION 33 - EXTERIOR IMPROVEMENTS**

SECTION 33 05 16 – UTILITY STRUCTURES SECTION 33 11 00 – WATER SYSTEM SECTION 33 31 00 – SANITARY SEWAGE SYSTEMS SECTION 33 41 00 – STORM DRAIN SYSTEMS

#### **END OF TABLE OF CONTENTS**



#### **SECTION 10 14 53**

#### **PARKING AREA SIGNS**

#### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Accessible parking warning signs.
- B. Designated accessible parking stall signs.
- C. Fire lane law signs.
- D. Tow-Away Signs.
- E. Non-Illumuniated Regulatory Sign.
- F. Posts, mounting brackets, fasteners, and accessories.

#### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. CBC California Building Code, 2016.
- C. ASTM American Society for Testing and Materials
  - ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - 2. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 3. ASTM D4956-01a Reflective Sheeting for Traffic Controls.
  - 4. ASTM B209-96 Aluminum and Aluminum-Allov Sheet and Plate.
- D. FED-STD-595B Colors used in Government Procurement.
- E. California Vehicle Code.
- F. MUTCD Department of Transportation, Manual for Uniform Traffic Control Devices.
- G. IR 11B-7 Interpretation of Regulations, Title 24 California Building Standards Code, California Building Code Chapter 11B, Requirements for Accessible Parking Spaces.

#### 1.03 SUBMITTALS

- A. Product data listing sign styles, lettering and locations and overall dimensions of each sign.
- B. Three samples illustrating full size sample sign, of type, style and color specified.



#### 1.04 REGULATORY REQUIREMENTS

- A. Conform to CBC for accessibility provisions.
- 1.05 DELIVERY, STORAGE AND HANDLING
  - A. Store and protect products.

#### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Products of following manufacturers form basis for design and quality intended.
  - Western Highway Products, Inc., Stanton, CA.
- B. Or equal in accordance with Division 1, General Requirements for Substitutions.

#### 2.02 CONSTRUCTION

- A. Post- and Wall-Mounted Signs: fabricated from 0.080- to 0.063-inch thick, Alloy 5052-H32 or 5053-H38 aluminum, with screen-printing on 3M, Type 2, Engineer Grade reflective sheeting.
- B. Mount signs to posts with minimum two 3/16-inch diameter round head bolts with tamperproof nuts, galvanized.
- C. Posts:
  - 1. 2 inch diameter galvanized steel pipe weighing minimum of 3.65 pounds per foot and conforming to ASTM A53 Schedule 40.
- D. Comply with Transportation, Manual for Uniform Traffic Control Devices.

#### 2.03 ACCESSIBLE PARKING WARNING SIGNS AT TRAFFIC ENTRY

A. Warning Sign: Post- or Wall-Mounted Sign, not less than 17 by 22 inches with 1-inch high lettering and reading per CBC 11B-502.8.1. Coordinate with owner for telephone numbers, blank lines not permitted. Sign shall read:

"Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at owner's expense. Towed vehicles may be reclaimed at

- [\_\_\_\_\_] or by telephoning ### ###-###."
- 1. Insert address and telephone number indicated on Drawings. A blank space or line for on-site modification is not permitted.
- 2. All lettering, including reclamation contact information, shall be permanent part of factory produced sign.
- B. Position sign in conspicuous location immediately adjacent to each entrance to off street parking facility or immediately adjacent to and visible from each stall or space.



- C. Sign shall be mounted 36-inches maximum from bottom of sign to adjacent finish grade or ground or 80 inches to pedestrian way or sidewalk, or as indicated on Drawings.
- D. Comply with California Building Code Section 11B-502.8 and Transportation, Manual for Uniform Traffic Control Devices.

#### 2.04 ACCESSIBLE PARKING STALL SIGNS

- A. Designated Accessible Parking Space Signs: Post-Mount Signs, not less than 70 square inches with white reflectorized copy on contrasting color FED-STD 595C, No.15090 blue background. Sign shall display International Symbol of Accessibility conforming to CBC Sections 11B-703.7.2.1 and the proportions in indicated the ADA Standards.
  - 1. An additional sign or additional language below the symbol of accessibility shall state "Minimum Fine \$250", Section 11B-502.6.2.
- B. Position one sign at end of each parking space designated for disabled usage.
- C. One in every eight spaces, but not less than one, also shall display a "Van Accessible" sign below symbol of accessibility.
- D. Sign shall be mounted 80 inches from bottom of sign to finish grade of parking space or centered on wall at interior end of parking space at minimum height of 36 inches above parking space, finished grade, ground or sidewalk, or as indicated on Drawings.
- E. Comply with California Building Code Section 11B-502 and Transportation, Manual for Uniform Traffic Control Devices.

#### 2.05 FIRE LANE LAW SIGNS

- A. Single post mount, 6 feet, 8 inches from bottom of sign to finish grade.
- B. Fire Lane Law Sign shall be 24 inches wide by 18 inches high with white and black letters fabricated with sign in contrasting color design. Coordinate with owner for telephone numbers, blank lines not permitted. Sign shall read:

TRAFFIC AND PARKING LAWS ENFORCED

THIS PROPERTY SUBJECT TO ALL REGULATIONS AND CONTROLS PROVIDED BY THE CITY OF \_\_\_\_\_\_ ORDINANCES AND CVC 22500.1 VIOLATORS WILL BE TOWED AT OWNERS EXPENSE, CITY OF \_\_\_\_\_ POLICE DEPARTMENT (area code) (telephone number)

C. Comply with Transportation, Manual for Uniform Traffic Control Devices.

#### 2.06 TOW-AWAY SIGNS

A. Single post mount, 6 feet, 8 inches from bottom of sign to finish grade, unless noted otherwise.



- B. Tow-away sign, Seton or equal, shall be 12 inches wide x 18 inches high x .125 inches thick with white and black letters fabricated with sign in contrasting color design. Engineer-Grade Reflective and High-Intensity Reflectivity aluminum.
- C. Refer to Drawings.

#### 2.07 NON-ILLUMINATED REGULATORY SIGNS

- A. Sign shall be constructed of an extruded aluminum plate sign panel.
- B. Sign panel shall be a 0.080-inch aluminum plate with surface applied 3M engineer grade regulatory reflective sheeting High Intensity Grade 3. Panel mechanically fastens to support post with tamper resistant fasteners.
- C. Posts: 2-inch diameter galvanized steel pipe weighing minimum of 3.65 pounds per foot and conforming to ASTM A53 Schedule 40.
- D. Sign to be installed with direct burial of post into concrete. If sign is to be installed with a base plate / "J" bolt type mounting, anchor at four locations, tack weld hex nuts to prevent removal.
- E. Signs shall be reflective traffic control symbols complying to Department of Transportation, Manual for Uniform Traffic Control Devices (MUTCD) in color, shape proportions, text and symbols.

#### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Beginning of installation means installer accepts existing surfaces.

#### 3.02 INSTALLATION

- A. Set posts in 3000 psi concrete base, minimum 12-inch diameter and 18 inches deep. Signs set in asphalt, concrete paved surfaces or concrete sidewalks shall be set in core-drilled holes minimum 8-inch diameter, 18 inches deep with top of base flush to finish. Signs mounted to walls shall be attached firmly with appropriate expansion anchors or bolting, adhesive not permitted. Seal all holes watertight.
- B. Clean and polish.

#### **END OF SECTION**



#### **SECTION 12 93 00**

#### SITE FURNISHINGS

#### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Site furnishings and improvement items applicable to Work and not specified under individual technical sections.
- B. Related Sections:
  - 1. Section 32 13 13, Sitework Concrete.

#### 1.02 SUBMITTALS

- A. Shop drawings and product data for components, hardware and accessories. Show construction and fabrications details, procedures, layout and erection diagrams, anchorages and pertinent information for specified specialty item.
- B. Samples sufficiently sized to illustrate clearly all sizes, available colors, materials, patterns and finishes.
- C. Manufacturer's installation instructions and maintenance recommendations.

#### 1.03 FIELD MEASUREMENTS

A. Verify site conditions. Obtain accurate dimensions of openings, levels, locations and arrangements of embedded and concealed anchorages. Report discrepancies between drawings and field dimensions to Architect before commencing work.

#### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Metal Tables and Seating; by Landscape Forms, Kalamazoo, MI, or equal.
  - 1. Tables: Carousel
    - a. material, style, height and finish: as indicated
  - 2. Seating
    - a. material, style, height and finish: as indicated



#### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site furnishings, where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored or positioned at locations indicated on Drawings.

#### 3.03 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

#### **END OF SECTION**



#### **SECTION 26 01 00**

#### **ELECTRICAL GENERAL PROVISIONS**

#### ARTICLE 1 SUMMARY

- 1.1 This Division of the specification outlines the provisions of the contract work to be performed under this Division.
- This Section applies to and forms a part of each section of specifications in 1.2 Division 26 and all work performed under the electrical and communications contracts.
- 1.3 In addition, work in this Division is governed by the provisions of the bidding requirements, contract forms, general conditions and all sections under general requirements.
- 1.4 These specifications contain statements which may be more definitive or more restrictive than those contained in the General Conditions. Where these statements occur, they shall take precedence over the General Conditions.
- 1.5 Where the words 'provide' or 'provision' are used, it shall be definitely interpreted as 'furnishing and installing complete in operating condition'. Where the words 'as indicated' or 'as shown' are used, it shall mean as shown on contract drawings.
- 1.6 Where items are specified in the singular, this Division shall provide the quantity as shown on drawings plus any spares or extras mentioned on drawings or specifications. All specified and supplied equipment shall be new.

#### ARTICLE 2 CONTRACTOR QUALIFICATIONS

2.1 The Contractor shall have a current California C-10 Electrical Contractor's license and all individuals working on this project shall have passed the Department of Industrial Relations Division of apprenticeship Standards -"Electrician Certification Program."

#### ARTICLE 3 CODES, PERMITS AND FEES

- 3.1 Comply with all applicable laws, ordinances, rules, regulations, codes, or rulings of governmental units having jurisdiction as well as standards of NFPA, and serving utility requirements.
- 3.2 Obtain permits, fees, inspections, meter and the like, associated with work in each section of this Division.
- 3.3 Installation procedures, methods and conditions shall comply with the latest requirements of the Federal Occupational Safety and Health Act (OSHA).



#### ARTICLE 4 EXAMINATION OF PREMISES

4.1 Examine the construction drawings and premises prior to bidding. No allowances will be made for not being knowledgeable of existing conditions.

#### ARTICLE 5 STANDARDS

- 5.1 The following standard publications of the latest editions enforced and supplements thereto shall form a part of these specifications. All electrical work must, as a minimum, be in accordance with these standards.
  - 5.1.1 2016 California Electrical Code (CEC), Part 3 Title 24 CCR.
  - 5.1.2 National Fire Protection Association.
  - 5.1.3 Underwriters' Laboratories, Inc. (UL).
  - 5.1.4 Certified Ballast Manufacturers' Association (CBM).
  - 5.1.5 National Electrical Manufacturers' Association (NEMA).
  - 5.1.6 Institution of Electrical & Electronics Engineers (IEEE).
  - 5.1.7 American Society for Testing & Materials (ASTM).
  - 5.1.8 National Board of Fire Underwriters (NBFU).
  - 5.1.9 National Board of Standards (NBS).
  - 5.1.10 American National Standards Institute (ANSI).
  - 5.1.11 Insulated Power Cable Engineers Association (IPECS).
  - 5.1.12 Electrical Testing Laboratories (ETL).
  - 5.1.13 National Electrical Safety Code (NESC).
  - 5.1.14 2016 California Building Code (CBC), Part 2, Title 24 CCR.
  - 5.1.15 2016 California Fire Code (CFC), Part 9, Title 24, CCR.
  - 5.1.16 2016 NFPA 72 with California State Amendments
  - 5.1.17 National Electrical Testing Association (NETA), 2010 or most current

#### ARTICLE 6 DEFINITIONS

- 6.1 Concealed: Hidden from sight, as in trenches, chases, hollow construction, or above furred spaces, hung ceilings acoustical or plastic type, or exposed to view only in tunnels, attics, shafts, crawl spaces, unfinished spaces, or other areas solely for maintenance and repair.
- 6.2 Exposed, Non-Concealed, Unfinished Space: A room or space that is ordinarily accessible only to building maintenance personnel, a room noted on the 'finish schedule' with exposed and unpainted construction for walls, floors, or ceilings or specifically mentioned as 'unfinished'.
- 6.3 Finish Space: Any space ordinarily visible, including exterior areas.

#### ARTICLE 7 WORK AND MATERIALS

7.1 Unless otherwise specified, all materials must be new and of the best quality. Materials previously incorporated into other projects, salvaged, or refurbished are not considered new. Perform all labor in a thorough and workmanlike manner.



7.2 All materials provided under the contract must bear the UL label where normally available. Note that this requirement may be repeated under equipment specifications. In general, such devices as will void the label should be provided in separate enclosures and wired to the labeled unit in proper manner.

#### ARTICLE 8 SHOP DRAWINGS AND SUBMITTALS

- 8.1 Submit shop drawings and all data in accordance with Division 1 of these specifications and as noted below for all equipment provided under this Division.
- 8.2 Shop drawings submittals demonstrate to the Architect that the Contractor understands the design concept. The Contractor demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods of material and equipment he intends to use. If deviations, discrepancies, or conflicts between submittals and specifications are discovered either prior to or after submittals are processed, notify the Architect immediately.
- 8.3 Manufacturer's data and dimension sheets shall be submitted giving all pertinent physical and engineering data including weights, cross sections and maintenance instructions. Standard items of equipment such as receptacles, switches, plates, etc., which are cataloged items, shall be listed by manufacturer.
- 8.4 Index all submittals and reference them to these specifications. All submittal items shall be assembled and submitted, one for each specification section. (Multiple specification sections may be grouped together in one common submittal binder, as long as each individual section is clearly identified.) Partial or incomplete submittal sections will not be reviewed.

#### ARTICLE 9 EQUIPMENT PURCHASES

- 9.1 Arrange for purchase and delivery of all materials and equipment within 20 days after approval of submittals. All materials and equipment must be ordered in ample quantities for delivery at the proper time. If items are not on the project in time to expedite completion, the Owner may purchase said equipment and materials and deduct the cost from the contract sum.
- 9.2 Provide all materials of similar class or service by one manufacturer.

#### ARTICLE 10 COOPERATIVE WORK

- 10.1 Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration.
- 10.2 Cooperative work includes: General supervision and responsibility for proper location and size of work related to this Division, but provided under the other



sections of these specifications, and installation of sleeves, inserts, and anchor bolts for work under each section in this Division.

#### ARTICLE 11 VERIFICATION OF DIMENSIONS

- 11.1 Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions, etc., and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.
- 11.2 Drawings are essentially diagrammatic, and many offsets, bends, pull boxes, special fittings, and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact location, routes, building obstructions, etc. and install apparatus and equipment in manner and locations to avoid obstructions, preserve headroom, keep openings and passageways clear, and maintain proper clearances.

#### ARTICLE 12 CUTTING AND PATCHING

- 12.1 All cutting and patching shall be in accordance with Division 1 of these specifications and as noted below.
- 12.2 Cut existing work and patch as necessary to properly install new work. As the work progresses, leave necessary openings, holes, chases, etc., in their correct location. If the required openings, holes, chases, etc., are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members including wall framing without the consent of the Architect.

#### ARTICLE 13CLOSING-IN OF UNINSPECTED WORK

13.1 Cover no work until inspected, tested, and approved by the Architect. Where work is covered before inspection and test, uncover it and when inspected, tested, and approved, restore all work to original proper condition at no additional cost to Owner.

#### ARTICLE 14 EXCAVATION AND BACKFILL

- 14.1 All excavation and backfill shall be in accordance with Division 1 of these specifications and as noted below.
- 14.2 Perform all necessary excavation, shoring, and backfilling required for the proper laying of all conduits inside the building and premises, and outside as may be necessary.
- 14.3 Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms no wider than necessary to provide ample work room. Grade trench bottoms accurately. Machine grade only to the top line of the conduits, doing the remainder by hand. Do not cut any



- trench near or under footings without first consulting the Architect. All trenches shall be done in accordance with OSHA standards and regulations.
- 14.4 Backfilling shall be done with each layer compacted before another layer is added. No stones or coarse lumps shall be laid directly on a conduit or conduits.
- 14.5 Trenches shall be filled with the specified material. Sod, if any, shall be removed in cut sections and replaced in same manners.
- 14.6 Provide pumps and drainage of all open trenches for purposes of installing electrical duct and wiring.
- 14.7 Perform all backfilling in accordance with the requirements of and under the direction of the Geotechnical Engineer.
- 14.8 Where new underground trenching is required on sites or in any area where existing underground utilities exist, the Contractor shall provide an independent professional utility locating service to locate exact vertical and horizontal locations of all existing utilities. Where existing utilities are found the Contractor shall hand dig those areas to avoid disruption. The Contractor shall be responsible for immediate repairs to existing underground utilities damaged during construction. The Contractor shall repair all existing asphalt, concrete and landscape surfaces damaged or removed during construction to match their original conditions. Where trenching extends through public streets or roadways, the Contractor shall notify underground service alert in addition to the independent locating service 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133.

#### ARTICLE 15 CONCRETE

- 15.1 Where used for structures to be provided under the contract such as bases, etc., concrete work, and associated reinforcing shall be as specified under Division 3 of these specifications.
- 15.2 See other sections for additional requirements for underground vaults, cable ducts, etc.

#### ARTICLE 16ACCESSIBILITY

- 16.1 Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal, or replacement conveniently and accessibly throughout the finished building.
- 16.2 All required access doors or panels in walls and ceilings are to be furnished and installed as part of the work under this Section. Refer to Division 1 of these specifications and as noted below.
- 16.3 Where located in fire rated assemblies, provide doors which match the rating of the assembly and are approved by the jurisdictional authority.



- 16.4 Refer to 'finish schedule' for types of walls and ceilings in each area and the architectural drawings for rated wall construction.
- 16.5 Coordinate work of the various sections to locate specialties requiring accessibility with others to avoid unnecessary duplication of access doors.

#### **ARTICLE 17FLASHING**

17.1 Flash and counter flash all conduits penetrating roofing membrane as shown on Architectural drawings. All work shall be in accordance with Division 7 of these specifications.

#### ARTICLE 18 IDENTIFICATION OF EQUIPMENT

18.1 All electrical equipment shall be labeled, tagged, stamped, or otherwise identified in accordance with the following schedules:

#### 18.1.1 General:

- 18.1.1.1 In general, the installed laminated nameplates as hereinafter called for shall also clearly indicate its use, areas served, circuit identification, voltage and any other useful data.
- 18.1.1.2 All auxiliary systems, including communications, shall be labeled to indicate function.

#### 18.1.2 Lighting and Local Panelboards:

- 18.1.2.1 Panel identification shall be with white and black micarta nameplates. Letters shall be no less than 3/8" high.
- 18.1.2.2 Circuit directory shall be two column typewritten card set under glass or glass equivalent. Each circuit shall be identified by the room number and/or number of unit and other pertinent data as required.

#### 18.1.3 Distribution Switchboards and Feeders Sections:

- 18.1.3.1 Identification shall be with 1" x 4" laminated white micarta nameplates with black lettering on each major component, each with name and/or number of unit and other pertinent data as required. Letters shall be no less than 3/8" high.
- 18.1.3.2 Circuit breakers and switches shall be identified by number and name with 3/8" x 1-1/2" laminated micarta nameplates with 3/16" high letters mounted adjacent to or on circuit breaker or switch.



- 18.1.4 Disconnect Switches, Motor Starters and Transformers:
  - 18.1.4.1 Identification shall be with white micarta laminated labels and 3/8" high black lettering.
- 18.1.5 All communication system terminal boxes including T.V., telephone/intercom, security, fire alarm, clock, and computer networking shall be provided with white micarta laminated labels and 3/8" high black lettering.

#### ARTICLE 19 CONSTRUCTION FACILITIES

- 19.1 Furnish and maintain from the beginning to the completion all lawful and necessary guards, railings, fences, canopies, lights, warning signs, etc. Take all necessary precautions required by City, State Laws, and OSHA to avoid injury or damage to any persons and property.
- 19.2 Temporary power and lighting for construction purposes shall be provided under this Section. All work shall be in accordance with Division 1 of these specifications.

#### ARTICLE 20GUARANTEE

20.1 Guarantee all material, equipment and workmanship for all sections under this Division in writing to be free from defect of material and workmanship for one year from date of final acceptance, as outlined in the general conditions. Replace without charge any material or equipment proven defective during this period. The guarantee shall include performance of equipment under all site conditions, conditions of load, installing any additional items of control and/or protective devices, as required.

#### **ARTICLE 21 PATENTS**

21.1 Refer to the General Conditions for Contractor's responsibilities regarding patents.

### ARTICLE 22 PLUMBING (DIVISION 22) / HEATING, VENTILATING, AND AIR CONDTIONING (DIVISION 23) / ELECTRICAL – COORDINATION REQUIREMENTS

22.1 All electrical work performed for this project shall conform to the California Electrical Code, to Local Building Codes and in conformance with Division 22, 23, and 26 of these specifications, whether the work is provided under the "Plumbing", "Heating, Ventilating, and Air Conditioning", or the "Electrical" Division of these specifications. Where the Division 22 and/or Division 23 Contractor is required to provide electrical work, he shall arrange for the work to be done by a licensed Division 26 Contractor, using qualified electricians. The Division 22 and/or Division 23 Contractor shall be solely and completely responsible for the correct functioning of all equipment regardless of who provided the electrical work.



- 22.2 The work under Division 22 and/or Division 23 shall include the following:
  - 22.2.1 All motors required by mechanical equipment.
  - 22.2.2 All starters for mechanical equipment which are not provided under the electrical division as part of a motor control center or otherwise indicated on the electrical drawings.
  - 22.2.3 All wiring interior to packaged equipment furnished as an integral part of the equipment.
  - 22.2.4 All control wiring and conduit for mechanical control systems.
  - 22.2.5 All control systems required by mechanical equipment.
- 22.3 The work under Division 26 shall include the following:
  - 22.3.1 All power wiring and conduit; and conduit only for EMS control conductors between each building and the main control panel.
  - 22.3.2 Electrical disconnects as shown on the electrical drawings.
  - 22.3.3 Starters forming part of a motor control center.
- 22.4 All power wiring and conduit to equipment furnished under Division 22 and/or Division 23 shall be provided under Division 26. Control wiring and conduit, whether line voltage or low voltage, shall be provided under the division which furnishes the equipment.
- 22.5 Power wiring shall be defined as all wiring between the panelboard switchboard overcurrent device, motor control center starter or switch, and the safety disconnect switch or control panel serving the equipment. Also, the power wiring between safety disconnect switch and the equipment line terminals.
- 22.6 Control wiring shall be defined as all wiring, either line voltage or low voltage, required for the control and interlocking of equipment, including but not limited to wiring to motor control stations, solenoid valves, pressure switches, limit switches, flow switches, thermostats, humidistats, safety devices, smoke detectors, and other components required for the proper operation of the equipment.
- 22.7 All motor starters which are not part of motor control centers and which are required for equipment furnished under this Division shall be furnished and installed by the Division furnishing the equipment and power wiring connected under Division 26. Motor starters and control devices in motor control centers shall be furnished and installed under Division 26.



- 22.8 Division 26 Contractor shall make all final connections of power wiring to equipment furnished under this Division.
- 22.9 Wiring diagrams complete with all connection details shall be furnished under each respective Section.
- 22.10 Motor starters supplied by Plumbing and/or Heating, Ventilating and Air Conditioning shall be fused combination type minimum NEMA Size 1, and conform to appropriate NEMA standards for the service required. Provide NEMA type 3R/12 gasketed enclosures in wet locations. Provide all starters with appropriately sized overload protection and heater strips provided in each phase, hand/off auto switches, a minimum of 2 NO and NC auxiliary contacts as required, and an integral disconnecting means. For ½ horsepower motors and below, when control requirements do not dictate the use of a starter, a manual motor starter switch with overload protection in each phase may be provided. Acceptable manufacturers are Allen Bradley, General Electric, Square D, Furnas and Cutler Hammer.

#### ARTICLE 23 EQUIPMENT ROUGH-IN

23.1 Rough-in all equipment, fixtures, etc. as designed on the drawings and as specified herein. The drawings indicate only the approximate location of roughins. Mounting heights of all switches, receptacles, wall mounted fixtures and such equipment must be coordinated with the Architectural Designs. The Contractor shall obtain all rough-in information before progressing with any work for rough-in connections. Minor changes in the contract drawings shall be anticipated and provided for under this Division of the specifications to comply with rough-in requirements.

#### ARTICLE 24OWNER FURNISHED AND OTHER EQUIPMENT

24.1 Rough-in and make final connections to all Owner furnished equipment shown on the drawings and specified, and all equipment furnished under other sections of the specifications.

#### ARTICLE 25 EQUIPMENT FINAL CONNECTIONS

- 25.1 Provide all final connections for the following:
  - 25.1.1 All equipment furnished under this Division.
  - 25.1.2 Electrical equipment furnished under other sections of the specification.
  - 25.1.3 Owner furnished equipment as specified under this Division.

#### ARTICLE 26 INSERTS, ANCHORS, AND MOUNTING SLEEVES

- 26.1 Inserts and anchors must be:
  - 26.1.1 Furnished and installed for support of work under this Division.



- 26.1.2 Mounting of equipment that is of such size as to be free standing and that equipment which cannot conveniently be located on walls, such as motor starters, etc., shall be rigidly supported on a framework of galvanized steel angle of Unistrut or B-line systems with all unfinished edges painted.
- 26.1.3 Furnish and install all sleeves as required for the installation of all work under all Sections of this Division and for all communication systems including any communication systems described in this Section which are bid to the General Contractor. Sleeves through floors, roof, and walls shall be as described in "Conduit and Fittings" Section 26 05 33.

#### ARTICLE 27 SEISMIC ANCHORING

- 27.1 All switchgear and other free standing electrical equipment or enclosures shall be anchored to the floor and braced at the top of the equipment to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.12. The Contractor shall submit drawings signed by the Contractors registered structural Engineer indicating method of compliance prior installation.
- 27.2 All sound systems, communication, signal or data networking equipment or enclosures shall be anchored to the structure. Where details have not been provided on the drawings, anchorage shall comply with CBC Section 1616A.1.12. The Contractor shall submit drawings signed by the Contractors registered Structural Engineer indicating method of compliance prior to installation.

#### ARTICLE 28 RUST PROOFING

- 28.1 Rust proofing must be applied to all ferrous metals and shall be in accordance with Section 05500 of these specifications and as noted below.
  - 28.1.1 Hot-dipped galvanized shall be applied and after forming of angle-iron, bolts, anchors, etc.
  - 28.1.2 Hot-dipped galvanized coating shall be applied after fabrication for junction boxes and pull boxes cast in concrete.

#### **ARTICLE 29 GENERAL WIRING**

- 29.1 Where located adjacent in walls, outlet boxes shall not be placed back to back, nor shall extension rings be used in place of double boxes, all to limit sound transmission between rooms. Provide short horizontal nipple between adjacent outlet boxes, which shall have depth sufficient to maintain wall coverage in rear by masonry wall.
- 29.2 In those instances where outlet boxes, recessed terminal boxes, or recessed equipment enclosures are installed in a fire rated assembly, provide "Flamesafe FSD 1077" fire stopping pads or approved equal, over the outlet or box.



29.3 Complete rough-in requirements of all equipment to be wired under the contract are not indicated. Coordinate with respective trades furnishing equipment or with the Architect as the case may be for complete and accurate requirements to result in a neat, workmanlike installation.

#### ARTICLE 30 SEPARATE CONDUIT SYSTEMS

- 30.1 Each electrical and signal system shall be contained in a separate conduit system as shown on the drawings and as specified herein. This includes each power system, each lighting system, each signal system of whatever nature, telephone, standby system, sound system, control system, fire alarm system, etc.
- 30.2 Further, each item of building equipment must have its own run of power wiring. Control wiring may be included in properly sized conduit for equipment feeders of #6 AWG and smaller, having separate conduit for larger sizes.

#### **ARTICLE 31 CLEANUP**

- 31.1 In addition to cleanup specified under other sections, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any spattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.
- 31.2 Use steel brushes on exposed metal work to carefully remove rust, etc., and leave smooth and clean.
- 31.3 During the progress of the work, keep the premises clean and free of debris.

#### **ARTICLE 32 UTILITY SERVICES**

- 32.1 The Division 26 Contractor shall contact the serving utility companies; notify the serving power, telephone and cable TV utilities of the following:
  - 32.1.1 Name and address of Contractor.
  - 32.1.2 Estimated times of construction start, completion and required service connections.
  - 32.1.3 Project service voltage, phase load, and service size.
  - 32.1.4 Provide to the Architect written verification from each utility company indicating their concurrence with the contract documents.
- 32.2 Contractor shall notify underground service alert 48 hours before start of construction to determine location of existing utilities by calling (800) 422-4133. All work shall be in accordance with the Division 1 Sections of these specifications.



32.3 All utility company requirements shall be complied with and approval shall be obtained from the utility company for service equipment. Such as, verification of a field test of the ground fault protection on the main service equipment, panic hardware and etc.

#### **ARTICLE 33 PAINTING**

33.1 Paint all unfinished metal as required in accordance with Division 1 of these specifications. (Galvanized and factory painted equipment shall be considered as having a sub-base finish.)

#### ARTICLE 34 PROJECT CLOSEOUT

- 34.1 Prior to completion of project, compile a complete equipment maintenance manual for all equipment supplied under sections of this Division, in accordance with Division 1 of these specifications and as described below.
- 34.2 Equipment Lists and Maintenance Manuals:
  - 34.2.1 Prior to completion of job, Contractor shall compile a complete equipment list and maintenance manuals. The equipment list shall include the following items for every piece of material equipment supplied under this Section of the specifications:
    - 34.2.1.1 Name, model, and manufacturer.
    - 34.2.1.2 Complete parts drawings and lists.
    - 34.2.1.3 Local supply for parts and replacement and telephone number.
    - 34.2.1.4 All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment it was taken from.
- 34.3 Maintenance manuals shall be furnished for each applicable section of the specifications and shall be suitably bound with hard covers and shall include all available manufacturers' operating and maintenance instructions, together with "as-built" drawings to properly operate and maintain the equipment. The equipment lists and maintenance manuals shall be submitted in duplicate to the Architect for approval not less than 10 days prior to the completion of the job. The maintenance manuals shall also include the name, address, and phone numbers of all subcontractors involved in any of the work specified herein. Four copies of the maintenance manuals bound in single volumes shall be provided.

#### ARTICLE 35 RECORD DRAWINGS

35.1 The Division 26 Contractor shall maintain record drawings as specified in accordance with Division 1 of these specifications, and as noted below.



- 35.2 Drawings shall show locations of all concealed underground conduit runs, giving the number and size of conduit and wires. Underground ducts shall be shown with cross section elevations and shall be dimensioned in relation to permanent structures to indicate their exact location. Drawing changes shall not be identified only with referencing CORs and RFIs, the drawings shall reflect all of the actual additions or changes made. All as-built drawing information shall be prepared by the contractor in AutoCAD, updating the contract computer files as needed to reflect actual installed conditions for all site plans, lighting, power, communication, networking, audio visual, security or fire alarms systems included in the scope of work for this project.
- 35.3 One set of these record drawings shall be delivered to the Architect. The engineer will review documents for completeness, and will not be responsible for editing contractor computer files.

#### ARTICLE 36 CHANGES AND EXTRA WORK

- 36.1 When **changes** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:
  - 36.1.1 The material Costs shall **not exceed** the latest edition of the "Trade Service" end column "C" price list. The materials prices may be higher only where the Contractor can produce invoices to substantiate higher material costs. The Contractor shall submit a print out copy of the trade service sheets with the change order to substantiate these values.
  - 36.1.2 The labor Costs shall <u>not exceed</u> the latest edition of the "NECA Manual of Labor Units" <u>normal column</u>.
- When **credits** in work are requested, the Division 26 Contractor shall provide unit prices for the work involved in accordance with Division 1 of these specifications, and the following:
  - 36.2.1 The Material Costs shall **not be less than 80% of** the latest edition of the "Trade Service" end column price list. The materials prices may be lower only where the Contractor can produce invoices to substantiate lower material costs. Restocking fees may also be included in this amount where applicable.
  - 36.2.2 The Labor Costs shall **not be less than 80% of** the latest edition of the "NECA Manual of Labor Units" **normal column**.
- 36.3 Conduit pricing for conduits of all types sized 3" or smaller.

When changes in the scope of work require the Contractor to estimate conduit Installations, they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for conduit installation



represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

- 36.3.1 Couplings.
- 36.3.2 Set Screw or Compression Fittings, locknuts, Bushings and washers.
- 36.3.3 Conduit straps and associated screws or nails.
- 36.3.4 LB fittings or other specialty fittings or specialty mounting hardware may be included where needed.
- 36.4 Wire pricing for all types and sizes.

When changes in the scope of work require the Contractor to estimate wire installations they shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for wire installation represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.

- 36.4.1 Locknuts, Bushings, tape, wire markers.
- When changes in the scope of work require other equipment installations such as lighting fixtures, panelboards, switchboards, wiring devices, communications equipment etc. the Contractor shall **NOT include labor values (only material cost may be included)** for any of the below items. The labor values for these equipment items represented in the NECA manual are inflated to a point where additional labor for the below items can not be justified.
  - 36.5.1 Associated screws, nails, bolts, anchors or supports.
  - 36.5.2 Locknuts, washers, tape.
- 36.6 The total labor hours for extra work will be required to be calculated as follows:
  - 36.6.1 Change orders with 1 to 30 total labor hours

General Laborer	10%	of total labor hours
Journeyman	10%	of total labor hours
Foreman	80%	of total labor hours

36.6.2 Change orders with 31 to 100 total labor hours

General Laborer	20%	of total labor hours
Journeyman	40%	of total labor hours
Foreman	40%	of total labor hours

36.6.3 Change orders with over 100 total labor hours



General Laborer	30%	of total labor hours
Journeyman	50%	of total labor hours
Foreman	20%	of total labor hours

- 36.7 When change orders are issued which allow the work to be completed in the normal sequence of construction, the labor rates shall be based on the most current "Prevailing Wage" straight time total hourly rate. When change orders require the Contractor to work out of sequence the "Prevailing Wage" daily overtime hourly rate shall apply. Special condition situations shall be reviewed on an individual basis for alternate hourly rate schedules.
- 36.8 Costs <u>will not</u> be permitted for additional supervision on site or office time for processing any change order other than the 10% overhead allowance as described in Division 1. Cost for special equipment required to install items for an individual change order are permitted and must be individually identified. Lump Sum cost for small tools or any other cost not specifically required for the change order are not permitted.
- 36.9 Contractor estimates shall be formatted to clearly identify each of the following:
  - 36.9.1 Line item description of each type of material or labor item.
  - 36.9.2 Description of quantity for each item.
  - 36.9.3 Description of (material cost per / quantity).
  - 36.9.4 Description of (labor cost per / quantity).
  - 36.9.5 Description of total labor hour breakdown per Foreman, Journeyman or General Laborer as described above.

#### ARTICLE 37 ELECTRONIC FILES

- 37.1 The Contractor shall make a <u>written</u> request directly to Johnson Consulting Engineers for electronic drawing files. As a part of the written request, please include the following information:
  - 37.1.1 Clearly indicate each drawing sheet needed (i.e., E1.1, E2.1, etc.).
  - 37.1.2 Identify the name, phone number, mailing address and e-mail address of the person to receive the files.
  - 37.1.3 Provide written confirmation and agreement with the requirements described for payment of computer files, as described below.
- 37.2 Detail or riser diagram sheets, or any other drawings other than floor plans or site plans, *will not be made available to the Contractor*.
- 37.3 Files will only be provided in the AutoCAD format in which they were created.



37.4 Requests for files will be processed as soon as possible; a minimum of 7 working days should be the normal processing time. The Contractor shall be completely responsible for requesting the files in time for their use.

**END OF SECTION** 



#### **SECTION 26 05 19**

#### **POWER CONDUCTORS**

#### PART 1 - GENERAL

- 1.1 Furnish and install wire and cable for branch circuits and feeders specified herein and as shown on the electrical drawings.
- 1.2 Submittals: Submit manufacturers' data for the following items:
  - 1.2.1 All cables and terminations

### 1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining, or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed

#### PART 2 - PRODUCTS

- 2.1 Wire and cable Rated 120 volt to 600 volt.
  - 2.1.1 All wire and cable shall be new, 600 volt insulated copper, of types specified below for each application. All wire and cable shall bear the UL label and shall be brought to the job in unbroken packages. Wire insulation shall be the color as specified herein and shall be type THWN-2. Insulated conductors shall be installed in all exterior exposed raceways. Conductors for branch circuit lighting, receptacle, power and miscellaneous systems shall be a minimum of No. 12 AWG. Increase conductor size to No. 10 AWG for 120 volt circuits greater than 100 feet from the panel to the load and for 277 volt circuits greater than 200 feet from the panel to the load. Circuit home-runs indicated to be larger than No. 12 must be increased the entire length of the circuit, including equipment grounding conductor. Wire sizes No. 14 through No. 10 shall be solid. No. 8 and larger shall be stranded.



- 2.1.2 Aluminum conductors will be permitted (only where specifically identified on the drawings. See "600 Volt Feeder Schedule") in sizes 2/0 or larger. Conductors shall be listed by Underwriters Laboratories (UL) and suitable for operation at 600 volts or less, at a maximum operating temperature of 90N C maximum in wet or dry locations. Conductors shall be marked "SUN-RES". Aluminum alloy conductors shall be compact stranded conductors of STABILOY® (AA-8030) as manufactured by Alcan Cable or Listed equal. AA-8000 Series aluminum alloy conductor material shall be recognized by The Aluminum Association.
- 2.1.3 MC type armored cable reference Section 26 05 33.
- 2.2 Wire and cable for systems below120 volts.
  - 2.2.1 All low voltage and communications systems cables routed underground shall be provided with a moisture resistant outer jacket, West Penn "Aquaseal" or equal, unless otherwise specified.

#### PART 3 - EXECUTION

- 3.1 Wire and cable shall be pulled into conduits without strain using powdered soapstone, mineralac, or other approved lubricant. In no case shall wire be repulled if same has been pulled out of a conduit run for any purpose. No conductor shall be pulled into conduit until conduit system is complete, including junction boxes, pull boxes, etc.
- 3.2 All connections of wires shall be made as noted below:
  - 3.2.1 Connections to outlets and switches: Wire formed around binding post of screw.
  - 3.2.2 No. 10 wire and smaller: Circuit wiring connections to lighting fixtures and other hard wired equipment shall be made with pressure type solderless connectors, Buchanan, Scotchlock, Wing Nut, or approved equal. Alternate "WAGO" #773 series or "IDEAL" #32, 33, 34 and 39 series push wire style connectors are also acceptable.
- 3.3 All wiring shall be continuous without splicing unless where specifically noted on the drawings or where permitted below.
  - 3.3.1 No. 10 wire and smaller above grade: Quantities as needed, connection made with pressure type solderless connectors, Scotchlock or equal.
  - 3.3.2 No. 10 wire and smaller below grade: Quantities as needed, connection made with 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).



- 3.3.3 No. 8 wire and larger above grade: Quantities <u>only</u> where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).
- 3.3.4 No. 8 wire and larger below grade: Quantities only where indicated, 'Raychem' long barrel compression terminals with crimping tool and quantity of crimps as recommended by manufacturer, provide 'Raychem' WCSM-S series in-line heat shrink, sealant coated splice kit. Alternate products must be UL listed for direct burial/submersible and rated to (1000V).
- 3.4 All wiring throughout shall be color coded as follows:

	480 volt system	208 or 240 volt system
A Phase	Brown	Black
B Phase	Orange	Red
C Phase	Yellow	Blue
Neutral	Grey	White
Ground	Green	Green

- 3.5 Wiring must be color coded throughout its entire length, except feeders may have color coded plastic tape at both ends and any other accessible point.
- 3.6 All control wiring in a circuit shall be color coded, each phase leg having a separate color, and with all segments of the control circuit, whether in apparatus or conduit, utilizing the same color coding.
- 3.7 At all terminations of control wiring, the wiring shall have a numbered T&B or Brady plastic wire marker.
- 3.8 Cables when installed are to be properly trained in junction boxes, etc., and in such a manner as to prevent any forces on the cable which might damage the cable.
- 3.9 All conductors to be installed into a common raceway, shall be pulled into the raceway at the same time.
- 3.10 All conductors shall be installed in such a manner as to not exceed the manufacturers' recommended pulling tension and bending radius. The equipment used for pulling must be specifically designed for the purpose. Motorized vehicles such as pickup trucks, are not acceptable.

#### **END OF SECTION**





#### **SECTION 26 05 26**

#### GROUNDING

#### PART 1 - GENERAL

- 1.1 Furnish and install grounding and grounding conductors and electrodes as specified herein and as shown on the drawings.
- 1.2 Submit catalog data for all components.

### 1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

#### PART 2 - EXECUTION

#### 2.1 Grounding

- 2.1.1 All panelboard cabinets, equipment, enclosures, and complete conduit system shall be grounded securely in accordance with pertinent sections of CEC Article 250. Conductors shall be copper. All electrically operated equipment shall be bonded to the grounded conduit system. All non-current carrying conductive surfaces that are likely to become energized and subject to personal contact shall be grounded by one or more of the methods detailed in CEC Article 250. All ground connections shall have clean contact surfaces. Install all grounding conductors in conduit and make connections readily accessible for inspection.
- 2.1.2 Provide an insulated equipment grounding conductor in all branch circuit and feeder raceway systems, sized in accordance with CEC 250-1122.



- 2.1.3 Provide an additional individual insulated grounding conductor for each circuit which contains an isolated ground receptacle or surge suppression receptacle.
- 2.1.4 Grounding of metal raceways shall be assured by means of provisions of grounding bushings on feeder conduit terminations at the panelboard, and by means of insulated continuous stranded copper grounding wire extended from the ground bus in the panelboard to the conduit grounding bushings.
- 2.1.5 Except for connections which access for periodic testing is required, make grounding connections which are buried or otherwise inaccessible by exothermite type process.
- 2.1.6 The following ohmic values shall be test certified for each item listed. A written report signed and witnessed by the project IOR shall be provided to the engineer. If the ohmic value listed cannot be obtained additional grounding shall be installed to reach the value listed.

**END OF SECTION 260526** 



#### **SECTION 26 05 33**

#### **CONDUIT AND FITTINGS**

#### PART 1 - GENERAL

- 1.1 Furnish and install conduit and fittings as shown on the drawings and as specified herein.
- 1.2 Submit Manufacturer's data on the following:
  - 1.2.1 Conduit.
  - 1.2.2 Fittings
  - 1.2.3 Fire stopping Material.

## 1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

#### PART 2 - PRODUCTS

- 2.1 Rigid steel conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT) and flexible metallic conduit shall be steel, hot dipped galvanized after fabrication.
- 2.2 PVC conduit shall be Carlon or approved equal.
- 2.3 Liquid tight flexible metal conduit shall be Anaconda Sealtite type UA or approved equal. Fittings shall be Appleton, Crouse-Hinds, Steel City, T&B, or equivalent.
- 2.4 MC type armored cable not approve for this project.



- 2.5 Fire stopping material shall provide an effective seal against fire, heat, smoke and fire gases. Fire stopping material shall be tested to comply with ASTME 814 and UL 1479. The submittal for this product shall include the UL listed system number and installation requirements for each type of penetration seal required for this project.
- 2.6 Each length of conduit shall be stamped with the name or trademark of the manufacturer and shall bear the UL label.
- 2.7 All plastic conduit shall be rigid, schedule 40, heavy wall PVC. All PVC conduit shall be UL listed. Underground utility company conduits shall comply with local utility co. requirements.
- 2.8 Plastic conduit shall be stored on a flat surface, and protected from the direct rays of the sun.

#### PART 3 - FITTINGS

- 3.1 All metallic fittings, including those for EMT, flexible conduit, or malleable iron. Die cast fittings of any other material are not permitted.
- 3.2 Locknuts shall be steel or malleable iron with sharp clean cut threads.
- 3.3 Entrance seals shall be 0.Z. type FSK or equivalent.
- 3.4 Bushings and locknuts: Where conduits enter boxes, panels, cabinets, etc., they shall be rigidly clamped to the box by locknuts on the outside, and a lock nut and plastic bushing on the inside of the box. All conduits shall enter the box squarely.
- 3.5 Furnish and install insulated bushings as per CEC article No. 300 4 (F) on all conduits. The use of insulated bushings does not exclude the use of double locknuts to fasten conduit to the box.
- 3.6 Transition from plastic to steel conduits shall be with PVC female threaded adaptors.
- 3.7 Couplings and connectors for rigid steel or IMC conduit must be threaded, or compression type (set screw fittings are not permitted).
- 3.8 Couplings and connectors for EMT shall be compression, watertight. Set screw connectors are not acceptable, except for systems below 120 volts.
- 3.9 Install approved expansion fittings, or liquid tight flex conduit with a minimum 6" slack for conduits passing through all expansion and seismic joints.

#### PART 4 - EXECUTION



- 4.1 All branch circuits shall be installed concealed in walls or above ceilings or in concrete floor slabs. PVC conduits installed in concrete floor slabs shall transition to PVC coated rigid steel where conduits penetrate above finished grade or finished floor.
- 4.2 Conduit sizes for various numbers and sizes of wire shall be as required by the CEC, but not smaller than ½" for power wiring and ¾" for communications and fire alarm systems unless otherwise noted. Conduit in slab or below grade shall be ¾" minimum trade size, unless otherwise identified.
- 4.3 Conduit size shall be such that the required number and sizes of wires can be easily pulled in and the Contractor shall be responsible for the selection of the conduit sizes to facilitate the ease of pulling. Conduit sizes shown on the drawings are minimum sizes in accordance with appropriate tables in the CEC. If because of bends or elbows a larger conduit size is required, the Contractor shall so furnish without further cost to the Owner.
- 4.4 The Contractor shall be entirely responsible for the proper protection of this work from the other trades on the job. When conduit becomes bent or holes are punched through same, or outlets moved after being roughed-in, the Contractor shall replace same, without additional cost to the Owner.
- 4.5 Rigid steel conduit or IMC shall be used as follows:
  - 4.5.1 Exposed exterior locations.
  - 4.5.2 Exposed interior locations below eight feet above floor, except in electrical rooms and closets.
  - 4.5.3 In hazardous or classified areas as required by CEC.
- 4.6 EMT conduit shall be used for areas as follows:
  - 4.6.1 All interior communications, signal, and data networking systems.
  - 4.6.2 All interior power wiring systems where not required to be in rigid steel, IMC or flexible conduit.
- 4.7 Flexible conduit shall be used for areas as follows:
  - 4.7.1 To connect motors, transformers, and other equipment subjected to vibration or where specifically detailed on the drawings.
  - 4.7.2 Flexible conduit shall not be used to replace EMT in other locations where the conduit will be exposed.
  - 4.7.3 Flexible metal conduit shall be ferrous. Installation shall be such that considerable slack is realized. The conduit shall contain separate code sized grounding conductor.



- 4.7.4 Liquid tight flexible conduit shall be used in conformance with CEC in lengths not to exceed 4'. For equipment connections, route the conduit at 90 degrees to the adjacent path for point of connection. The conduit shall contain separate code sized grounding conductor. Use liquid tight flexible conduit for all equipment connections exposed in possible wet, corrosive or oil contaminated areas, e.g., shops and outside areas.
- 4.8 Plastic conduit shall be used for all exterior underground, in slab, and below slab on grade conduit installations. Install bell ends at all conduit terminations in manholes and pull boxes. Where plastic conduit transitions from below grade to above grade, no plastic conduit shall extend above finished exterior grade, or above interior finished floor level.
- 4.9 Plastic conduit joints shall be made up in accordance with the manufacturer's recommendations for the particular conduit and coupling selected. Conduit joint couplings shall be made watertight. Plastic conduit joints shall be made up by brushing a plastic solvent cement on the inside of a plastic fitting and on the outside of the conduit ends. The conduit and fitting shall then be slipped together with a quick one-quarter turn twist to set the joint tightly.
- 4.10 All underground conduit depths shall be as detailed on the drawings or a minimum of 30" below finished grade (when not specifically detailed otherwise), for all exterior underground conduits. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.
- 4.11 All underground conduits for power systems (600v and higher), shall be concrete encased and a minimum of 48" below grade or as detailed on the drawings. Where concrete slurry or concrete encasement is provided, include "Red" color dye in mixture.
- 4.12 Conduit shall be continuous from outlet to outlet, cabinet or junction box, and shall be so arranged that wire may be pulled in with the minimum practical number of junction boxes.
- 4.13 All conduits shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, electrical closets, and in existing or unfinished spaces. No conduit shall be run exposed in finished areas without the specific approval of the Architect.
- 4.14 All raceways which are not buried or embedded in concrete shall be supported by straps, clamps, or hangers to provide a rigid installation. Exposed conduit shall be run in straight lines at right angles to or parallel with walls, beams, or columns. In no case shall conduit be supported or fastened to other pipes or installed to prevent the ready removal of other trades piping. Wire shall not be used to support conduit.
- 4.15 It shall be the responsibility of the Contractor to consult the other trades before installing conduit and boxes. Any conflict between the location of conduit and



- boxes, piping, duct work, or structural steel supports, shall be adjusted before installation. In general, large pipe mains, waste, drain, and steam lines shall be given priority.
- 4.16 Conduits above lay-in grid type ceilings shall be installed in such a manner that they do not interfere with the "lift-out" feature of the ceiling system. Conduit runs shall be installed to maintain the following minimum spacing wherever practical.
  - 4.16.1 Water and waste piping not less than 3".
  - 4.16.2 Steam and steam condensate lines not less than 12".
  - 4.16.3 Radiation and reheat lines not less than 6".
- 4.17 Provide all necessary sleeves and chases required where conduits pass through floors or walls as part of the work of this section. Core drilling will only be permitted where approved by the Architect.
- 4.18 All empty conduits and surface mounted raceways shall be provided with a ¼" polypropylene plastic pull cord and threaded plastic or metal plugs over the ends. Fasten plastic "Dymo" tape label to exposed spare conduit to identify "power" or "communication" system, and to where it goes.
- 4.19 The ends of all conduits shall be securely plugged, and all boxes temporarily covered to prevent foreign material from entering the conduits during construction. All conduit shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place.
- 4.20 Bending: Changes in direction shall be made by bends in the conduit. These shall be made smooth and even without flattening the pipe or flaking the finish. Bends shall be of as long a radius as possible, and in no case smaller than CEC requirements.
  - 4.20.1 For power conduits for conductors (600v and below), provide minimum 36" radius (vertical) and 72" radius (horizontal) bends.
  - 4.20.2 For power conduits for conductors (greater than 600v), provide minimum 72" radius (vertical) and 72" radius (horizontal) bends.
- 4.21 Supports: Conduit shall be supported at intervals as required by the California Electrical Code. Where conduits are run individually, they shall be supported by approved conduit straps or beam clamps. Straps shall be secured by means of toggle bolts on hollow masonry, machine screws or bolts on metal surfaces, and wood screws on wood construction. [No perforated straps or wire hangers of any kind will be permitted. Where individual conduits are routed, or above ceilings, they shall be supported by hanger rods and hangers.] Conduits installed exposed in damp locations shall be provided with clamp backs under each conduit clamp, to prevent accumulation of moisture around the conduits.



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- Where a number of conduits are to be run exposed and parallel, one with another, they shall be grouped and supported by trapeze hangers. Hanger rods shall be fastened to structural steel members with suitable beam clamps or to concrete inserts set flush with surface. A reinforced rod shall be installed through the opening provided in the concrete inserts. Beam clamps shall be suitable for structural members and conditions. Rods shall be galvanized steel 3/8" diameter minimum. Each conduit shall be clamped to the trapeze hanger with conduit clamps.
- 4.23 All concrete inserts and pipe clamps shall be galvanized. All steel bolts, nuts, washers, and screws shall be galvanized or cadmium plated. Individual hangers, trapeze hangers and rods shall be prime-coated.
- 4.24 Openings through fire rated floors/walls and/or smoke walls through which conduits pass shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. Sleeves shall be provided for power or communication system cables which are not installed in conduits, and shall be sealed inside and out to comply with manufacturers UL system design details. Where multiple conduits and/or cable tray systems pass thru fire-rated walls at one location, the Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.
- 4.25 Provide cap or other sealing type fitting on all spare conduits. Conduits stubbed into buildings from underground where cable only extends to equipment, the conduit/cable end shall be sealed to prevent moisture from entering the room or space.
- 4.26 All conduits which are part of a paralleled feeder or branch circuit shall be installed underground.
- 4.27 All conduits which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.
  - 4.27.1 The Contractor shall coordinate all conduit requirements with each system supplier prior to bid to determine special conduit system requirements.
  - 4.27.2 The Contractor shall provide a pull rope in all conduits for these systems.
  - 4.27.3 The Contractor shall provide conduit sleeves for all open cable installations thru rated walls or block walls. Provide conduit from each building main termination cabinet or backboard to the nearest accessible ceiling for access into all electrical or communications rooms.
- 4.28 In addition to the above requirements, the following requirements shall apply to all data networking conduits:

CONDUIT AND FITTINGS



- 4.28.1 Flexible metal conduit may only be used where required at building seismic and/or expansion joints.
- 4.28.2 All underground conduits shall be provided with minimum 24" radius elbows (vertical) and 60" (horizontal).
- 4.28.3 No length of conduit above grade shall be installed to exceed 150 feet between pull boxes, or points of connection, unless where specifically detailed on the drawings.
- 4.28.4 No length of conduit shall be installed to exceed two 90 degree bends between pull boxes, or points of connection, unless where specifically detailed on the drawings.



## **SECTION 26 05 34**

#### **OUTLET AND JUNCTION BOXES**

### PART 1 - GENERAL

- 1.1 Furnish and install electrical wiring boxes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.

# 1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

## PART 2 - PRODUCTS

- 2.1 Boxes shall be as manufactured by Steel City, Appleton, Raco, or approved equal.
- 2.2 All boxes must conform to the provisions of Article 370 of the CEC. All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Minimum box size shall be 4" square x 1-½" deep.
- 2.3 Boxes generally shall be hot dipped galvanized steel with knockouts. Boxes on exterior surfaces or in damp locations shall be corrosion resistant, cast feraloy and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Boxes shall be Appleton Type FS, Crouse-Hinds, or the approved equal. Conduit bodies shall be corrosion resistant, cast malleable iron. Conduit bodies shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Conduit bodies shall be Appleton Unilets, Crouse-Hinds, or the approved equal. Where recessed, boxes shall have square cut corners.
- 2.4 Deep boxes shall be used in wall covered by wainscot or paneling and in walls or glazed tile, brick, or other masonry which will not be covered with plaster.



Through the wall type boxes shall not be used unless specifically called for. All boxes shall be nongangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars. All lighting fixture outlet boxes shall be equipped with the proper fittings to support and attach a light fixture.

- 2.5 All light, switch, receptacle, fire alarm devices and similar outlets shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this contract.
- 2.6 Pull and junction boxes shall be code gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle from framing where required. Boxes shall be 4" square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas. Covers for flush mounted oversize boxes shall extend 3/4" past boxes all around. Covers for 4" square boxes shall extend 1/4" past box all around.
- 2.7 All terminal cabinets and junction boxes or equipment back boxes which are required as a part of systems specified in Divisions 27 or 28, or any other low voltage communication systems, shall be furnished and installed by the Division 26 Contractor.
  - 2.7.1 The Division 26 Contractor shall coordinate all box requirements with each system supplier prior to bid to determine special cabinet or back box requirements. The Contractor shall also provide stainless steel blank cover plates for all low voltage systems installed for future equipment.
  - 2.7.2 The Contractor shall provide all plywood backboards indicated on walls or inside equipment enclosures. All backboards shall be a minimum of 3/4" thick fire rated type plywood.
  - 2.7.3 The Contractor shall coordinate exact rough in locations and requirements with each system supplier.
- 2.8 In addition to the above requirements, boxes for data networking wiring and equipment shall comply with the following:
  - 2.8.1 All boxes shall be a minimum of 4-11/16" square x 2-1/8" deep.
  - 2.8.2 Where pull boxes are required on individual conduits 1-¼" or smaller, provide 4-11/16" square x 2-1/8" deep boxes. Where pull boxes are required on conduits larger than 1-¼" for straight pull through, provide eight times the conduit trade size for box length. Where pull boxes are required on conduits larger than 1-¼" for an angle or a U-pull through installation, provide a minimum distance of six times the conduit trade size between the entering and exiting conduit run for each cable.



2.9 Recessed boxes installed in fire rated floors/walls and /or smoke walls shall be sealed by Fire stopping material to comply with Division 1 to seal off flame, heat, smoke and fire gases. The Contractor shall submit copies of the manufacturers UL system design details proposed for use on this project. All Fire stopping material shall have an hourly fire-rating equal to or higher than the fire rating of the floor or wall through which the conduit, cables, or cable trays pass.

## PART 3 - EXECUTION

- 3.1 Boxes shall be installed where required to pull cable or wire, but in finished areas only by approval of the Architect. Boxes shall be rigidly attached to the structure, independent of any conduit support. Boxes shall have their covers accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface mounted boxes shall line up evenly with the edges of the boxes.
- 3.2 Outlets are only approximately located on the plans and great care must be used in the actual location of the outlets by consulting the various detailed drawings and specifications. Outlets shall be flush with finished wall or ceiling, boxes installed symmetrically on such trim or fixture. Refer to drawings for location and orientation of all outlet boxes.
- 3.3 Furnish and install all plaster rings as may be required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Where required, extension rings shall be installed so that the plaster ring is flush with the finished surface.
- 3.4 All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces and wood screws on wood construction. All wall and ceiling mounted outlet boxes shall be supported by bar supports extending from the studs or channels on either side of the box. Boxes mounted on drywall or plaster shall be secured to wall studs or adequate internal structure.
- 3.5 Boxes with unused punched-out openings shall have the openings filled with factory-made knockout seals.
- 3.6 Where standby power and normal power are to be located in the same outlet box or 480V in a switch box, install partition barriers to separate the various systems.
- 3.7 All device boxes and junction boxes for fire alarm system shall be painted red and shall be 4-11/16" square by 2-1/8" deep. No exceptions.



## **SECTION 26 05 43**

### **UNDERGROUND PULL BOXES AND MANHOLES**

### PART 1 - GENERAL

- 1.1 Furnish and install electrical underground pullboxes and manholes as specified and as shown on the electrical drawings.
- 1.2 Submit manufacturer's data for all items.

# 1.3 <u>Common submittal mistakes which will result in the submittals being</u> rejected:

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

### PART 2 - PRODUCTS

- 2.1 The concrete for pull boxes and manholes shall be class 5500 psi or as noted on the drawings. All pullboxes and manholes and covers located in parking lots, driveways, roads, or any other driveable areas shall be traffic rated.
- 2.2 Each manhole shall be provided with a fiberglass ladder and ground rod. Ground rods shall be copper or a copper-clad steel 3/4" diameter by 10-feet long. All non-current carrying metallic components shall be grounded to the ground rods with minimum #6 copper wire.
- 2.3 All underground pullboxes shall be provided with steel bolt down type covers. Bolts shall be bronze or brass. All communication or signal system pullboxes shall be sized to comply with CEC Article 370 unless where other sizes are specifically noted on the drawings.
- 2.4 All underground pullbox and manhole covers shall be provided with either "electrical" or "telephone" or "fire alarm" markings. The telephone marking shall be used to identify telephone, T.V., clock or any other types of communication systems.



2.5 All power and communication systems shall be provided with separate pullboxes or manholes. Fire alarm circuits shall also be provided with separate pullboxes from any other type of communication systems.

## PART 3 - INSTALLATION

- 3.1 Shoring of the excavation shall be in accordance with all federal, state and local regulations.
- 3.2 Provide sealing material for the joints between sections per manufacturer's instructions.
- 3.3 The contractor shall make the top and access assembly or lid flush with surrounding areas where installed in driveable or normal walking areas.



## **SECTION 26 08 00**

### COMMISSIONING OF ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### RELATED DOCUMENTS

- 1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, 27, 28 Specification Sections, apply to this Section.
- 1.2 Acceptance and start-up testing requirements for electrical power distribution equipment and systems. Contractor shall retain and pay for the services of a recognized, independent testing firm for the purpose of performing inspections and tests as herein specified and as required by code.
  - 1.2.1 The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.
  - 1.2.2 It is the purpose of these tests to assure that all tested electrical equipment is operational and within industry and manufacturers tolerances, and is installed in accordance with design specifications.
  - 1.2.3 The tests and inspections shall determine suitability for start-up and energization.
  - 1.2.4 The following equipment shall be tested and calibrated:
    - 1.2.4.1 Medium voltage cables
    - 1.2.4.2 Medium voltage interrupter switches, fuses, and circuit breakers.
    - 1.2.4.3 Low voltage switches, fuses, and circuit breakers, 100A frame and larger.
    - 1.2.4.4 Low voltage cables and feeders.
    - 1.2.4.5 Motor Control Centers and adjustable frequency drives.
    - 1.2.4.6 Protective relays, instruments, and metering systems.

# CODES, STANDARDS, AND REFERENCES

- 1.3 All inspections and tests shall be in accordance with the following codes and standards except as provided otherwise herein.
  - 1.3.1 ANSI/IEEE C2: National Electrical Safety Code (NESC).



- 1.3.2 ANSI/NFPA 70: National Electrical Code, with California Amendments (CEC).
- 1.3.3 ANSI/NFPA 70E: Standard for Electrical Safety in the Workplace.
- 1.3.4 ANSI/NFPA 78: Lightning Protection Code.
- 1.3.5 ANSI/NFPA 101: Life Safety Code.
- 1.3.6 American Society for Testing and Materials ASTM.
- 1.3.7 Applicable State and Local Codes, Ordinances and Standards, including City of San Diego, San Diego Gas & Electric, and San Diego Unified School District.
- 1.3.8 California Code of Regulations (CCR), Title 8, Title 24.
- 1.3.9 Division 1, Section 019113, "General Commissioning Requirements".
- 1.3.10 Institute of Electrical and Electronic Engineers IEEE.
- 1.3.11 Insulated Cable Engineers Association ICEA.
- 1.3.12 International Electrical Testing Association NETA Accept: The NETA Acceptance Testing Specifications, latest edition.
- 1.3.13 National Electrical Manufacturers Association NEMA.
- 1.3.14 Occupational Safety and Health Administration (OSHA) 29 CFR 1910.7: OSHA Occupational Safety and Health Standards.

## QUALIFICAITONS OF TESTING FIRM

- 1.4 All Inspections and tests shall utilize the following references:
  - 1.4.1 Project design specifications.
  - 1.4.2 Project design drawings
  - 1.4.3 Project list of equipment to be inspected and tested
  - 1.4.4 Manufacturer's instruction manuals applicable to each particular equipment.
- 1.5 The testing firm shall be an independent testing organization with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.



- 1.6 The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems, with at least five (5) years of documented experience.
- 1.7 The lead, on-site, technical person shall be currently certified by the International Electrical Association (NETA), or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.
- 1.8 The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.
- 1.9 The testing firm shall submit proof of the above qualifications with bid documents when requested.
- 1.10 The terms used herein, such as Testing Agency, Testing Contractor, Testing Laboratory, or Contractor Test Company, shall be construed to mean the testing firm.

## **SUBMITTALS**

- 1.11 Provide submittals per Division 1, Section 013300, "Submittal Procedures".
- 1.12 Qualifications of testing firm and personnel.
- 1.13 Certified test reports.
- 1.14 Two copies of blank forms for checklists, test reports, and other related forms for Engineer's review and approval.

## **GENERAL REQUIREMENTS**

- 1.15 Routine insulation resistance, continuity, and rotation tests for all distribution and utilization equipment shall be performed prior to and in addition to acceptance tests specified herein.
- 1.16 The Testing Firm shall notify the Engineer no fewer than 3 working days prior to commencement of any testing.
- 1.17 Any system, material, or workmanship, which is found defective on the basis of Acceptance Tests shall be reported to the Engineer with recommendations for corrective action.
- 1.18 The Testing Firm shall maintain a written record of all tests, and upon completion of project, shall assemble and certify a final test report.
- 1.19 The final Test Report shall be submitted on conclusion of all required tests and corrective measures.

### SAFETY AND PRECAUTIONS



- 1.20 Safety practices shall include, but will not be limited to, compliance with the following requirements:
  - 1.20.1 Occupational Safety and Health Act.
  - 1.20.2 Accident Prevention Manual for Industrial Operations, National Safety Council.
  - 1.20.3 Applicable State and Local safety operating procedures.
  - 1.20.4 Owners' Safety Practices.
  - 1.20.5 National Fire Protection Association NFPA 70E.
  - 1.20.6 American National Standards for Personnel Protection.
- 1.21 All tests shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and adequate safeguards must be devised.
- 1.22 The Testing Firm shall have a designated safety representative on the project site to supervise the testing operations with respect to safety.
- 1.23 Test Report:
  - 1.23.1 The test report shall include the following:
    - 1.23.1.1 Summary of Project.
    - 1.23.1.2 List of testing equipment used.
    - 1.23.1.3 Calibration date of testing equipment and due date of next calibration.
    - 1.23.1.4 Ambient temperature and humidity at time of test.
    - 1.23.1.5 Listing of equipment tested.
    - 1.23.1.6 Test results.
    - 1.23.1.7 Recommendations.
  - 1.23.2 Furnish original and four copies of the complete report to the Architect/District in accordance with requirements of Contract Documents.

### INSPECTION AND TEST PROCEDURES

1.24 Contractor shall provide the Testing Firm, a copy of related contract documents such as drawings, specifications, engineer-reviewed submittals, coordination study report including all relay settings and other necessary information.



- 1.25 Contractor shall supply a suitable source of power to each site and location per testing firm requirements.
- 1.26 Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
- 1.27 Testing Firm shall review and evaluate all received documents and notify the Contractor and Engineer of any discrepancies in the documents and/or any other requirements immediately.
- 1.28 Testing Firm shall provide and comply with the following:
  - 1.28.1 Acceptance test procedures for each individual equipment listed in Part 1 of this section for Engineer review and approval prior to any test and after thorough evaluation of the system. Testing shall conform to the International Electrical Testing Association (NETA) specifications and standards for electrical power distribution equipment and systems and manufacturer's instructions.
  - 1.28.2 Refer to each individual specification section for testing requirements and comply.
  - 1.28.3 Inspect installed equipment and report any discrepancy and/or deficiency with respect to the contract documents and governing codes prior to testing.

### SYSTEM FUNCTION TEST

- 1.29 Perform system function test upon completion of equipment tests as defined in this section. It is the purpose of system function tests to verify proper interaction of all sensing, processing, and action devices.
- 1.30 Implementation.
- 1.31 Submit manufacturers' data on all items:
  - 1.31.1 Develop test parameters for the purpose of evaluation performance of all integral components and their functioning as a complete unit within design requirements.
  - 1.31.2 Test all interlocking devices.
  - 1.31.3 Record the operation of alarms and indicating devices.
- 1.32 DEFICIENCIES
- 1.33 Submit manufacturers' data on all items.



1.33.1 All deficiencies reported by the Testing Firm shall be corrected by the Contractor and Acceptance and System Function Tests shall be repeated to verify conformance with requirements.

PART 2 - PRODUCTS

2.1 Not applicable

PART 3 - EXECUTION



## **SECTION 26 09 24**

### **TIME CLOCKS**

# PART 1 – GENERAL

- 1.1 Furnish and install all time clocks that are not specifically called for to be furnished by others.
- 1.2 Submit manufacturer's data.

# 1.3 Common submittal mistakes which will result in submittals being rejected:

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

## PART 2 - PRODUCTS

- 2.1 Acceptable manufacturers are Tork, Paragon, or Intermatic.
- 2.2 Contacts shall have a minimum rating of 10 amperes at 120V.
- 2.3 Controller is to have two channels. Both channels shall be astronomic with 1 to 99 minutes, plus or minus offset from sunrise or sunset.
- 2.4 Controller shall program in AM/PM or 24-hour format, with one minute resolution, suing two buttons for all basic settings.
- 2.5 Controller shall be capable of 48 events per channel per week, and separate scheduling for each day of the week.
- 2.6 Controller shall have the following features:
  - 2.6.1 Scheduling of 16 individual holiday dates, and five holiday blocks.
  - 2.6.2 Automatic leap year compensation, and daylight saving.
- 2.7 Controller shall have 72-hour memory backup with rechargeable backup.



- 2.8 Clock shall be housed in a flush enclosure where supply circuits emanate from a flush mounted panelboard and surface enclosure when supply circuits are from a surface mounted panel.
- PART 3 EXECUTION
  - 3.1 Furnish and install time clocks as shown on the drawings and herein specified.



## **SECTION 26 22 13**

## **DRY TYPE TRANSFORMERS**

# PART 1 - GENERAL

- 1.1 Furnish and install where indicated on the drawings dry type transformers with voltage and phase as shown on the drawings. The transformers shall be 60 Hz with KVA rating as shown on the drawings.
- 1.2 Submit shop drawings and manufacturer's data for each transformer including:
  - 1.2.1 Incident energy level calculations

# 1.3 <u>Common submittal mistakes which will result in the submittal being rejected:</u>

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

## PART 2 - PRODUCTS

- 2.1 Acceptable manufacturers are Square D, Eaton-Cutler Hammer, or Siemens
- 2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1 are <u>not</u> considered equal, or approved for use on this project.
- 2.3 Energy efficient transformers shall be provided in compliance with NEMA TP-1 and requirements as outlined in the California Code of Regulations, Title 20: Division 2, Chapter 4, Article 4, Sections 1601-1609: Appliance Efficiency Regulations and California Code of Regulations, Title 24: part 6, Subchapter 2, Sections 110-11: Building Standards. Transformers shall also meet the Class 1 Efficiency levels for distribution transformers specified in Table 4-2 of the National Electrical Association (NEMA) TP-102002, Guide for Determining Energy Efficiency for Distribution Transformers" The TP-1 efficiency rating will apply to both conventional transformers and K-rated transformers.
- 2.4 Transformers shall comply with the latest NEMA and ANSI standards.



- 2.5 Transformers shall be encased in a sheet steel enclosure. Ten (10) KVA and smaller shall be non-ventilated, and above 10 KVA shall be ventilated, self-cooled. The core and coil assembly shall be completely isolated from the enclosure by means of neoprene rubber isolation pads or other acceptable vibration isolators. Transformers installed outdoors shall be provided with suitable rain shields and shall be UL listed for outdoor installation.
  - 2.5.1 Fan cooled transformers will not be accepted.
- 2.6 Transformers shall have a 185 \( \text{C} \) insulation system and shall not exceed 115 \( \text{C} \) rise above a 40 \( \text{C} \) ambient under full load conditions.
- 2.7 Transformers shall be capable of operating at 100 PCT. for taps below normal. Transformers rated 30 KVA and larger shall be 6 2-1/2 PCT., four below, and two above normal.
- 2.8 Transformer cable termination compartment shall be rated at not more than 75 degrees C.
- 2.9 Transformers shall have aluminum windings.
- 2.10 Sound outputs of transformers shall not exceed the following levels, based on NEMA standard testing procedures:

KVA Rating	Decibel Sound Output
0-9	40
10 - 50	45
51 - 150	50
151 - 300	55
301 - 500	60

## PART 3 – EXECUTION

- 3.1 Dry type transformers larger than 112.5KVA rating shall have a minimum of twelve inches clearance between transformer ventilation openings and adjacent structure. Transformer connections shall be made with flexible conduit.
- 3.2 All lugs shall be torque tested in the presence of the inspector of record.
- 3.3 Transformers shall be anchored to the structure to resist seismic activity in accordance with Zone 4 requirements. Provide a minimum of four (4) ½-inch diameter anchor bolts for floor or roof mounted transformers.
- 3.4 Transformers mounted on roofs shall be installed on a roof curb. All conduits shall enter the transformer enclosure within the curbed area.
- 3.5 Arc Flash and Shock Hazard



- 3.5.1 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
- 3.5.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16. Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
- The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
- 3.5.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.



## **SECTION 26 24 13**

#### **SWITCHBOARDS**

## PART 1 – GENERAL

- 1.1 Furnish and install service entrance and distribution switchboards as herein specified and as shown on the drawings. In order to establish the minimum acceptable quality and type of equipment described in this section, the switchboard was technically and dimensionally designed around "Square D." If other acceptable manufacturer products listed in 2.1 are used, it shall be the responsibility of the Contractor to verify the equipment will meet the requirements of the design, both technically and dimensionally.
- 1.2 All electrical materials and equipment shall be new, and of the type and quality specified: Listed by Underwriters' Laboratories, and bear their label, where standards have been established; in compliance with the applicable standards of CEC (NFPA 70), NFPA, ANSI, IEEE, IPCEA and NEMA. All components and equipment enclosures shall be manufactured by the same manufacturer.

### 1.3 SUBMITTALS

- 1.3.1 Submit shop drawings and manufacturers' data on the switchboard and components including:
  - 1.3.1.1 Equipment elevation diagrams indicating the bussing configurations and ampere ratings.
  - 1.3.1.2 Coordination study and incident energy level calculations.
  - 1.3.1.3 Metering equipment
  - 1.3.1.4 Breakers or fused switches
  - 1.3.1.5 Surge Protective Device (SPD)

# 1.4 <u>Common submittal mistakes which will result in the submittals being</u> rejected:

- 1.4.1 Not including the Short Circuit and Coordination Study with the material submittals.
- 1.4.2 Not including all items listed in the above itemized description.
- 1.4.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.



- 1.4.4 Not including actual manufacturer's catalog information of proposed products.
- 1.4.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

### PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
  - 2.1.1 Acceptable manufacturers are:
    - 2.1.1.1 Siemens
    - 2.1.1.2 Eaton
    - 2.1.1.3 Square D
- 2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1, are <u>not</u> considered equal or approved for use on this project.
- 2.3 Switchboards shall be of the dead front, safety type with voltage and ampere capacity as indicated. Provide a 25% minimum tin plated aluminum ground bus running the full length of the switchboards. The neutral bus shall be **100**% rated throughout.
- 2.4 Where conductor sizes exceed the standard breaker lug wire range, or where multiple conductors per phase are required, the manufacturer shall provide the breaker with suitable lugs for terminating the specified conductors.
- 2.5 All bussing shall be tin plated aluminum and braced for a short circuit current of 100,000 RMS symmetrical amperes minimum, or as noted on the drawings. Horizontal and vertical bussing shall be 100% fully rated; not tapered unless otherwise noted on the drawings. All sections shall have full height bus.
- 2.6 The main circuit breaker (480 volt or 208 volt, 800 amp or larger) shall be a stored energy solid state trip insulated case type breaker and shall consist of a three-pole electrically and mechanically trip-free circuit breaker with inter-pole barriers, arc quenchers, manual stored-energy closing mechanism, mechanical push-button trip, position indicator, and equipped for fixed mounting in the switchboard section. Main breaker shall be 100% rated and shall be sized as indicated on the drawings. Minimum short circuit interrupting rating shall be 65,000 ampere symmetrical for all breakers in the main switchboard or as indicated on the drawings. For main breakers rated 2,500 amps and larger this rating shall be increased to 100,000 amps, or as indicated on the drawings.



- 2.6.1 The over current trip devices to be furnished with the main circuit breaker shall be of the three-phase construction and employ solid-state components in their design to afford combinations of long, short time, and instantaneous and ground fault characteristics (480 volt only) as specified. The circuit breaker and integral solid-state trip device shall be self-contained to include necessary power supply, transformers and tapped current level sensing transformers. An external source shall not be required to trip the circuit breaker under fault of overload conditions or to test the ground fault trip.
- 2.6.2 Field installed rating plug taps shall be provided.
- 2.6.3 Main breakers 400 amp and larger shall be solid state trip.
- 2.6.4 The main circuit breaker shall be provided with the following:
  - 2.6.4.1 Adjustable longtime delay element pickup.
  - 2.6.4.2 Adjustable short-time delay element pickup.
  - 2.6.4.3 The instantaneous trip element pickup shall be adjustable from 1.5 to 10 times the sensor setting or <u>none</u>.
- 2.6.5 The feeder circuit breakers (480 volt or 208 volt, 400 amp or larger) shall be solid state trip molded case type breakers. They shall consist of a three-pole electrically and mechanically trip-free circuit breakers with inter-pole barriers, arc quenchers, manual closing mechanism, position indicator, and equipped for fixed mounting in the switchboard section. The breakers shall be a minimum of 80% rated, unless otherwise identified on the drawings and shall be sized as indicated on the drawings. Minimum short circuit interrupting rating shall be 65,000 ampere symmetrical or as indicated on the drawings.
  - 2.6.5.1 The overcurrent trip devices to be furnished with these circuit breakers shall be of the three-phase construction and employ solid-state components in their design to afford combinations of long, short time, and instantaneous and ground fault characteristics (480 volt only) as specified. The circuit breaker and integral solid-state trip device shall be self-contained to include necessary power supply, transformers and tapped current level sensing transformers. An external source shall not be required to trip the circuit breaker under fault of overload conditions or to test the ground fault trip.
  - 2.6.5.2 Field installed rating plug taps shall be provided as required.
  - 2.6.5.3 These circuit breakers shall be provided with the following:
    - 2.6.5.3.1 Adjustable long-time delay element pickup.



- 2.6.5.3.2 Adjustable short-time delay element pickup.
- 2.6.5.3.3 The instantaneous trip element pickup shall be adjustable from 1.5 to 10 times the sensor setting.
- 2.6.5.3.4 Where the GFI function is required the settings shall be set at maximum levels.
- 2.7 Feeder breakers identified as 100% rating on the drawings may be molded case type below 1600 amp but 1600 amp and above shall be insulated case type. All breakers shall accept copper or aluminum conductors. Contractor must verify that the breaker can accept the possibility of aluminum conductors.
- 2.8 Circuit breakers less than 400 amps shall be molded case, trip free, quick-make, quick-break, thermal magnetic type, with handles clearly indicating rating and position-on, off, tripped.
- 2.9 Circuit breakers used in service entrance equipment, identified on the drawings shall have short circuit current ratings equal to the bracing and in no case smaller than 22,000 amperes RMS symmetrical.
- 2.10 The switchboard shall be manufactured to locate the utility company metering within the local utility company requirements, for maximum centerline height. This maximum height must include the 2-1/2" high (above finished grade) concrete housekeeping.
- 2.11 Provide a metal embossed nameplate adjacent to the switchboard rating, indicating the maximum short circuit current rating of the switchboard as determined by UL 891, September 30, 1982.
- 2.12 Where devices indicated are fusible type, fuses shall be Bussman or Littlefuse (no known equal).
- 2.13 Where a switchboard is indicated to be provided with an NEMA 3R (weatherproof) enclosure, the enclosure shall be manufactured to allow the equipment to mount flush against a vertical surface or wall. Rear roof equipment overhangs will not be permitted for weatherproof equipment.
- 2.14 Where auxiliary test kits or other devices are needed for setting breaker parameters they shall be supplied.

## **Service Entrance – Surge Protective Device**

- 2.15 IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- 2.16 IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits



- 2.17 IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- 2.18 National Electrical Code: Article 285
- 2.19 UL 1283 Electromagnetic Interference Filters
- 2.20 SPD shall be UL 1449 labeled as Type 1 or Type 4 intended for Type 1 applications, verifiable at UL.com without need for external or supplemental over current controls. Every suppression component of every mode, including N-G, shall be protected by internal over current and thermal over temperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of the specification
- 2.21 SPD shall be factory installed integral to electrical distribution equipment
- 2.22 SPD shall be UL labeled with 20kA I-nominal (I-n)
- 2.23 SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR)
- 2.24 Standard Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems.
- 2.25 SPD shall be connected to the buss of the distribution equipment with an appropriately sized 200kA SCCR rated disconnect
- 2.26 SPD shall meet or exceed the following criteria:
  - 2.26.1 MAXIMUM 7-Mode sure current capability per phase shall be 400kA for mountain and desert areas with over 5 lightning strikes per year.
  - 2.26.2 UL 1449 Third Edition Revisions; effective September 29, 2009 Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200	1200	2000V	320V
		V	V		

2.26.3 UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com)

	Allowable System voltage Fluctuation	
System Voltage	(%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

Allowable System Voltage Eluctuation

2.27

PD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of - 50dB at 100 kHz



- 2.28 Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.
- 2.29 SPD shall include a serviceable, replaceable module.
- 2.30 SPD shall be equipped with the following diagnostics:
  - 2.30.1 Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service Led
  - 2.30.2 Audible alarm with on/off silence function and diagnostic test function (excluding branch)
  - 2.30.3 Form C dry Contacts

No other test equipment shall be required for SPD monitoring or testing before or after installation.

2.30.4 SPD shall have a 10 year warranty

### **Short-Circuit and Coordination Studies**

- 2.31 The contractor shall provide the following studies; a time current and complete short-circuit study, equipment-interrupting or withstand evaluation, and a protective-device coordination study as described below for the distribution system. The equipment study shall be included with the equipment submittals. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum-fault conditions shall be thoroughly covered in the study. The studies are to be reviewed by a Professional Engineer registered in the State of California.
  - 2.31.1 All studies shall be performed by "Emerson Electric" (858) 695-9551, MTA (858) 472-0193, or Terra Power Solutions (858) 380-8170. Studies performed by manufactures or other engineering or testing companies must submit qualifications for approval by Johnson Consulting Engineers, 7 days prior to bid for this project.
- 2.32 Short-Circuit Study
  - 2.32.1 The study shall be in accordance with applicable ANSI and IEEE standards.
  - 2.32.2 The study input data shall include the short-circuit single- and three-phase contributions from all sources, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.



- 2.32.3 Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
- 2.32.4 For the portions of a system utilizing medium- and high-voltage breakers, separate calculations shall be made for one-half cycle (close and latch) currents and interrupting currents. Calculations shall be for three-phase and phase-to-ground faults at each bus under consideration.
- 2.32.5 For the portions of a system utilizing low-voltage breakers (less than 1,000 volts), calculations shall be made for three-phase and phase-to-ground interrupting currents at each bus under consideration.

## 2.33 Equipment Evaluation Study

2.33.1 An equipment evaluation study shall be performed to assure the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the maximum short-circuit momentary and interrupting duties. Series rating of over current protective devices shall be permitted to reduce the maximum available short circuit current to panelboard branch circuit breakers to no more than 10,000 amps symmetrical for the 120/208 volt system and 14,000 amps symmetrical for the 277/480 volt system.

## 2.34 Protective-Device Coordination Study

- 2.34.1 A protective-device coordination study shall be performed to select or to verify the selection of power fuse ratings, protective-relay characteristics and settings, ratios, and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings. Time current curves are to be colored to clearly indicate coordination.
- 2.34.2 The coordination study shall include all voltage classes of equipment from the source's incoming line protective device down to and including each motor control center and/or panelboard. The phase and ground over current protection shall be included as well as settings for all other adjustable protective devices. Ground fault settings are to, as a minimum coordinate with a downstream 50 amp branch circuit breaker.
- 2.34.3 Protective device selection and settings shall be in accordance with requirements of the National Electrical Code and the recommendations of the ANSI/IEEE Standard 399, as applicable.
- 2.35 Study Report



- 2.35.1 The results of the power-system studies shall be summarized in a final report. The report shall include the following sections:
  - 2.35.1.1 Description, purpose, basis, and scope of the study and a single-line diagram of the portion of the power system which is included within the scope of study.
  - 2.35.1.2 Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties and commentary regarding same.
  - 2.35.1.3 Protective device coordination curves, with commentary.
  - 2.35.1.4 The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system.
  - 2.35.1.5 Fault-current tabulations including a definition of terms and a guide for interpretation.
  - 2.35.1.6 The report must be submitted with the material submittal for the engineers approval.

## 2.36 Implementation

2.36.1 The equipment manufacturer is to be responsible for providing over current devices which are in compliance with the results of the above study.

### PART 3 – EXECUTION

- 3.1 Switchboard shall be provided with adequate lifting means and capable of being rolled or moved directly to the floor without the use of floor sills.
- 3.2 Switchboard installation shall be done in accordance with National Electrical Installation Standards (NECA 400-1998) for installing and maintaining switchboards.
- 3.3 Provide 2-1/2" concrete housekeeping pads for service entrance and distribution switchboards. For switchboards containing local utility company metering equipment, the concrete pad must be flush with the front edge of the switchboard enclosure.
- 3.4 Provide permanently affixed engraved nameplate stating UL listed fault current rating of switchboard assembly. Locate adjacent to the equipment nameplate on front of switchboard.



- 3.5 All lugs shall be torque tested in the presence of the inspector of record.
- 3.6 Arc Flash and Shock Hazard
  - 3.6.1 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
  - 3.6.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16. Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high. The label is not to identify the party performing the study but only the technical information needed.
  - 3.6.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
  - 3.6.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.



## **SECTION 26 24 16**

#### PANEL BOARDS

# PART 1 – GENERAL

- 1.1 Furnish and install branch circuit panel boards as specified herein and as indicated on the drawings. Submit manufacturers' data on all items.
- 1.2 Submit manufacturers' data on all panel boards and components including:
  - 1.2.1 Enclosures and covers
  - 1.2.2 Breakers
  - 1.2.3 Surge Protective Device (SPD) equipment
  - 1.2.4 Incident energy level calculations
  - 1.2.5 Common submittal mistakes which will result in the submittals being rejected:
    - 1.2.5.1 Not arranging the circuit breakers in panels to match the orientations indicated on the drawings. In other words, if a 30 amp breaker is shown on the drawing in Space #2, this must be the location it appears on the submittal schedule. Standard factory arrangements will not be accepted.
    - 1.2.5.2 Not including all items listed in the above itemized description.
    - 1.2.5.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
    - 1.2.5.4 Not including actual manufacturer's catalog information of proposed products.
    - 1.2.5.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

## PART 2 - PRODUCTS

2.1 The interrupting rating of circuit breakers shall be 10,000 amps for the 120/208 system and 14,000 amp for 277/480 volt systems. Refer to drawings for higher interrupting rating requirements. All components and equipment enclosures shall be manufactured by the same manufacturer. Circuit breakers shall be permitted



- to be series rated to limit the available fault current to no more than the above ratings.
- 2.2 All panels shall be fully bussed. Recessed panel enclosures shall be a maximum of 20" wide and 5-3/4" deep for all panels 600 amp rated and less.
- 2.3 All busses shall be tin-plated aluminum and shall be located in the rear of the panelboard cabinet. Individual circuit breakers shall be bolt on type and removable from the cabinet without disturbing the bussing in any way. All panel boards shall contain ground busses.
- 2.4 Panel covers shall be door in door style, with one lock. Door lock shall allow access to breakers only. Access to wireways without removal of cover shall be permitted by (non removable) screws behind the locked door. Panel cover shall be provided with full length piano hinge. All locks for all panels provided in this project shall be keyed alike.
- 2.5 Each panel shall have a two-column circuit index card set under glass or glass equivalent on the inside of the door. Each circuit shall be identified as to use and room or area. Areas shall be designated by room numbers. Room numbers shown on the drawings may change and contractor shall verify final room numbers with the architect prior to project completion.
- 2.6 Tandem mounted or wafer type breakers are not acceptable.
- 2.7 Multiple breakers shall have one common trip handle or be internally connected. Handle ties are not acceptable.
- 2.8 Breaker arrangements shown in the drawings shall be maintained. The circuit breakers in panels must match the orientations indicated on the drawings. In other words, if a 30 amp breaker is shown on the drawing in Space #2, this must be the location it appears on the submittal schedule. Standard factory arrangements will not be accepted.
- 2.9 Where conductor sizes exceed the standard breaker lug wire range, or where multiple conductors per phase are required, the panelboard manufacturer shall provide the breaker with suitable lugs for terminating the specified conductors.
- 2.10 Acceptable manufacturers are Square D, Eaton, or Siemens
- 2.11 Equipment manufactured by any other manufacturers not specifically listed in Section 2.10 are <u>not</u> considered equal, or approved for use on this project.

### **Surge Protective Devise (SPD)**

2.12 Surge Protective Device (SPD) panelboards, shall be provided with an integrated circuit breaker panelboard and parallel connected suppression / filter system in a single enclosure. The SPD panelboard shall meet the following parameters:



- IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, UL 1283 and the UL 1449, Third Edition, effective September 29, 2009.
- 2.13 The panelboard shall be UL 67 Listed and the SPD shall be UL 1449 labeled as Type 1 or Type 2 or as Type 4 intended for Type 1 or Type 2 applications. SPD shall be factory installed integral to the panel board.
- 2.14 The SPD panelboard shall be top or bottom feed according to requirements. A circuit directory shall be located inside the door.
- 2.15 SPD shall meet or exceed the following criteria:
  - 2.15.1 For standard areas supply SPD having 100kA per phase surge current capacity. For mountain and desert areas (areas with over 5 lightning strikes per year), SPD shall have a per phase surge current capacity of 200kA.
  - 2.15.2 UL 1449 Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<u>MCOV</u>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

- 2.15.3 SPD shall be UL labeled with 100kA Short Circuit Current Rating (SCCR).
- 2.16 UL 1449 Third Edition Revision; effective September 29, 2009, Voltage Protection Ratings shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>	<b>MCOV</b>
208Y/120	700V	700V	700V	1200V	150V
480Y/277	1200V	1200V	1200V	2000V	320V

- 2.17 SPD shall be UL labeled with a minimum 100kVA short circuit rated (SCCR).
- 2.18 UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	<b>MCOV</b>
208Y/120	25%	150V
480Y/277	15%	320V

- 2.19 SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of 50dB at 100 kHz. No filtering is required for a 100kA SPD.
- 2.20 Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.



- 2.21 Type 4 SPD shall include a serviceable, replaceable module.
- 2.22 SPD shall be equipped with the following diagnostics:
  - 2.22.1 Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
  - 2.22.2 No other test equipment shall be required for SPD monitoring or testing before or after installation.
- 2.23 SPD shall have a response time no greater than 1/2 nanosecond
- 2.24 SPD shall have a 10 year warranty
- 2.25 The SPD panelboard shall have removable interior
- 2.26 The SPD panelboard main bus shall be aluminum and rated for the load current required
- 2.27 The SPD panelboard shall include a 200% rated neutral assembly with copper neutral bus
- 2.28 The unit shall be provided with a safety ground bus

# (SPD) Quality Assurance

- 2.29 Manufacturer Qualifications: Engage a firm with at least 5 years experience in manufacturing transient voltage surge suppressors.
- 2.30 Manufacturer shall be ISO 9001 or 9002 certified.
- 2.31 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- 2.32 The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

## PART 3 – EXECUTION

- 3.1 Painting of panelboard covers in finished areas shall be done by the general contractor.
- 3.2 Provide a spare 3/4" conduit stubbed to an accessible area for each of every three (3) spares or spaces provided in recessed panel boards.
- 3.3 All lugs shall be torque tested in the presence of the inspector of record.

Arc Flash and Shock Hazard



- 3.4 The Contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
  - 3.4.1 All studies shall be performed by "Emerson Electric" (858) 695-9551, MTA (858) 472-0193, or Terra Power Solutions (858) 380-8170. Studies performed by manufactures or other engineering or testing companies must submit qualifications for approval by Johnson Consulting Engineers, 7 days prior to bid for this project.
- 3.5 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
- 3.6 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department
- 3.7 The design goal is to minimize the incident energy to which a maintenance employee may be exposed.



## **SECTION 26 27 13**

### **POWER PEDESTALS**

# PART 1 – GENERAL

- 1.1 Furnish and install service entrance meter pedestal as herein specified and as shown on the drawings. In order to establish the minimum acceptable quality and type of equipment described in this section, the meter pedestal is technically and dimensionally designed around "Myers." If other acceptable manufacturer products are used, it shall be the responsibility of the Contractor to verify that the equipment will meet the requirements of the design, both technically and dimensionally before being considered in the bid.
- 1.2 All electrical materials and equipment shall be new, and of the type and quality specified: Listed by Underwriters' Laboratories, and bear their label, where standards have been established; in compliance with the applicable standards of NEC (NFPA #70), NFPA, ANSI, IEEE, IPCEA, and NEMA. All components and equipment enclosures shall be manufactured by the same manufacturer.
- 1.3 Submittals: Submit shop drawings and manufacturer's data on switchboard and components, including:
  - 1.3.1 Equipment elevation diagrams indicating the bussing configurations and ampere ratings
  - 1.3.2 Breakers and fused switches.
  - 1.3.3 Incident energy level calculations

# 1.4 <u>Common submittal mistakes which will result in the submittals being</u> rejected:

- 1.4.1 Not including all items listed in the above itemized description.
- 1.4.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.4.3 Not including actual manufacturer's catalog information of proposed products.
- 1.4.4 Do not indicate multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

#### PART 2 - PRODUCTS

2.1 Acceptable manufacturers are Meyers.



- 2.2 The electrical service shall be a Meyers-type MEUGL, free-standing pedestal type. Service shall have distribution and utility section is complete with meter socket and factory-installed test blocks, and shall comply with the requirements of the serving utility. The pedestal shall be furnished as a complete pre-wired assembly.
- 2.3 Enclosure shall be zinc coated steel, minimum 12 gauge thickness. Cabinet shall be protected against corrosion in accordance with UL 50, cabinets and boxes, Section 13. Exterior covers to be minimum 14 gauge steel and shall have padlocking provisions. Deadfront shall be a hinged type, 16 gauge minimum, and shall not require the use of a tool to expose interior components for installation or servicing. All factory installed components shall be UL listed. All factory installed conductors shall be copper; size and type to conform to NEC and UL requirements.
- 2.4 Enclosure shall be furnished with a detachable sub-base designed to be encased in concrete. Enclosure shall fasten to sub-base with ½" diameter bolts. Mounting bolts shall be visible outside the enclosure after installation on sub-base.
- 2.5 Circuit breakers shall be molded case, trip free, quick-make, quick-break, thermal magnetic type, with handles clearly indicating rating and position on, off, tripped.
- 2.6 Circuit breakers used in service entrance equipment and distribution switchboards shall have short circuit current ratings equal to the bracing of the equipment and in excess of the available fault current and in no case smaller than 42,000 amperes RMS symmetrical.
- 2.7 Provide UL tested and certified series combination ratings of equipment to comply with all codes and utility requirements.
- 2.8 Provide a metal embossed nameplate adjacent to the meter pedestal rating, indicating the maximum short circuit current rating of the meter pedestal as determined by UL 891, September 30, 1982.
- 2.9 Provide light green powder coat finish in accordance with ASTM-B-117.

### PART 3 – EXECUTION

- 3.1 Meter pedestal shall be provided with adequate lifting means and capable of being rolled or moved directly to the floor without the use of floor sills.
- 3.2 Provide concrete equipment pads for meter pedestals containing local utility company metering equipment. The concrete pad must provide the working clearance space required by the service utility company.
- 3.3 Provide permanently affixed engraved name plate stating UL listed fault current rating of meter pedestal assembly. Locate adjacent to the equipment nameplate on front of meter pedestal.



- 3.4 Furnish and deliver to owner (6) six spare fuses for each type and size listed.
- 3.5 Arc Flash and Shock Hazard
  - 3.5.1 The contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
  - 3.5.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16. Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
  - 3.5.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
  - 3.5.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed and in no case more than 8 cal./cm².



# **SECTION 26 27 26**

## **SWITCHES AND RECEPTACLES**

# PART 1 - GENERAL

- 1.1 Furnish and install all wiring devices as shown on drawings and as herein specified. Unless otherwise noted, device and plate numbers shown are Hubbell and shall be considered the minimum standard acceptable. Other acceptable manufacturers are Pass and Seymour, Leviton, General Electric and Bryant.
- 1.2 Submit manufacturers' data on all items.

# 1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

- 1.3.1 Not correctly indicating ampacity rating of proposed devices.
- 1.3.2 Not including all items listed in the above itemized description.
- 1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.4 Not including actual manufacturer's catalog information of proposed products.
- 1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements or "to be determined later" statements. The products being submitted must be the products installed.

# PART 2 - PRODUCTS

2.1 All switches shall be of the quiet mechanical type, Specification Grade, 20 amp, 120/277 volt AC as follows:

	<b>HUBBELL</b>	<b>LEVITON</b>	PASS & SEYMOUR
Single Pole	CS120	CS1202	CS20AC1
Two Pole	CS1222	CS2202	CSB20AC2
Three-way	CS320	CS3202	CS20AC3
Key Switch	HBL1221L	1221-2L	PS20AC1-L

2.2 All switches shall have the "on" and the "off" position indicated on the handle. If switches of higher ampere ratings are required, they shall be of similar type and quality as those shown above. Groups of switches shown at one location shall be installed under a single plate up to a maximum of six where more than six switches are shown coordinate arrangement with the Architect.



- 2.3 Dimmer switches for incandescent lamp loads shall be square-law type, slide control dimmer with OFF position, Lutron or Hubbell "Nova-T" Series NT-600 (0-500 watt load), NT-1000 (501-900 watt load), NT-1500 (901-1500 watt load), or equal (no known equal).
- 2.4 All convenience receptacles and special outlets throughout shall be grounding type. Convenience receptacles shall be side wired, parallel slot, two pole, three wire, 20 amp as follows:

	<u>HUBBELL</u>	<b>LEVITON</b>	PASS & SEYMOUR
Duplex	5352	5362	PS5362
GFCI	GFR5362	7899	2097
Isolated Ground	IG5362	5362IG	IG6300
Tamper Proof		8300SG	TR63H

- 2.5 All safety or tamper proof receptacles shall have no exposed external current carrying metal parts, and shall have integral wiring leads suitable for two or three wire installations.
- 2.6 Special receptacles shall be as noted on the drawings.
- 2.7 Weatherproof plates shall be designed to meet CEC Article 410-57, wet location listed with cover "open." Where weatherproof receptacles have been identified to be provided with locking covers, the cover shall be as manufactured by Pass & Seymour #4600-8 or Cole Lighting 310 Series. Rough-in requirements vary between manufacturers. Contractor to field verify requirements prior to installation.
- 2.8 All plates throughout shall be stainless steel. Where wiring devices are installed in concrete block walls, provide oversized 3-1/2" x 5" coverplates.
- 2.9 All devices shall be white unless otherwise noted or a special purpose outlet.
- 2.10 Unless where specifically detailed on the drawings, floor boxes shall be PVC suitable for concrete poured floors of minimum 3-1/2" depth, with a modular design to gang two or three sections together.
  - 2.10.1 Carlon #E976 series or approved equal
  - 2.10.2 Provide brass cover with brass carpet flange unless otherwise detailed.

# PART 3 - EXECUTION

- 3.1 Switches for room lighting shall be located no more than 12" center line from door jamb at plus 48" center line above finished floor or +46" to top of devices where located over casework, reference CBC Figure 11B-5D.
- 3.2 All receptacles shall be mounted at plus 18" to center line above finished floor unless noted or shown otherwise. All receptacles shall be installed with the ground pin up, at the top of the receptacle to comply with IEEE 602-1986.



3.3 Furnish and install wall plates for all wiring devices, and outlet boxes, including special outlets, sound, communication, signal, and telephone outlets, etc. as required. All cover plates shall be appropriate for type of device.

**END OF SECTION** 



# **SECTION 26 28 16**

#### **DISCONNECTS**

# PART 1 - GENERAL

- 1.1 Furnish and install all disconnect switches as shown on the drawings and as required by the CEC.
- 1.2 Submit manufacturers' data for all disconnects and fuses.
  - 1.2.1 Disconnects
  - 1.2.2 Fuses

# 1.3 <u>Common submittal mistakes which will result in the submittals being rejected:</u>

- 1.3.1 Not including all items listed in the above itemized description.
- 1.3.2 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.3 Not including actual manufacturer's catalog information of proposed products.
- 1.3.4 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

#### PART 2 - PRODUCTS

- 2.1 Acceptable manufacturers shall be Square D, Cutler Hammer, or Siemens
- 2.2 Equipment manufactured by any other manufacturers not specifically listed in Section 2.1 are <u>not</u> considered equal, or approved for use on this project.
- 2.3 All switches shall be heavy-duty type, externally operated, quick-make, quick-break, rated 600 volts or 240 volts as required, with the number of poles and ampacity as noted. All switches for motors shall be HP rated. Switches shall have NEMA-Type 1 enclosures, except switches located where exposed to outdoor conditions shall have NEMA Type 3R enclosure. Switches generally shall be fused except where noted to be non-fused on the drawings.
- 2.4 Where fuses are indicated, fuses shall be Bussman or Littlefuse (no known equal). Fuses shall be current limiting type with time delay characteristics to suit the equipment served.

# PART 3 - EXECUTION



- 3.1 Mount all switches to structure or U-channel support. U-channel supports shall be cleaned and painted to prevent rust.
- 3.2 Switches shall be accessible with proper clearances in front per CEC 110-16.
- 3.3 All lugs shall be torque tested in the presence of the inspector of record.
- 3.4 Arc Flash and Shock Hazard
  - 3.4.1 The contractor is to provide, and submit to the engineer for approval, incident energy level calculations as determined using the methodologies described in NFPA 70E or IEEE standard 1584-2002.
  - 3.4.2 A warning label, as specified in the above standard, shall be placed on each switchboard, panelboard, and safety switch indicating the incident energy levels on the equipment to warn qualified personnel in accordance with NFPA 70E, section 110.16 Labels shall be laminated white micarta with black lettering on each. Letters shall be no less than 3/8" high.
  - 3.4.3 The incident level calculations for each piece of equipment shall be given to the owner and maintained on file by the maintenance department.
  - 3.4.4 The design goal is to minimize the incident energy to which a maintenance employee may be exposed and in no case more than 8 cal./cm<sup>2</sup>.

**END OF SECTION** 



# **SECTION 26 51 14**

## **LED LIGHTING FIXTURES AND LAMPS**

# PART 1 - GENERAL

- 1.1 Furnish and install all lighting fixtures with lamps as specified and as shown on the drawings. Fixtures shall be complete including canopies, hanger, diffusers, ballasts, etc.
- 1.2 Submit manufacturer's data for each fixture type including the following:
  - 1.2.1 Lighting fixture catalog data and photometry.
  - 1.2.2 Lamp catalog data for each fixture type.
  - 1.2.3 Driver catalog data for each fixture type.
  - 1.2.4 Fixture warranty.

# 1.3 <u>Common submittal mistakes which will result in the submittal being</u> rejected:

- 1.3.1 Not including lamp and driver information for each fixture type.
- 1.3.2 Not including all items listed in the above itemized description.
- 1.3.3 Including catalog cut sheets which have several items on a page, and not clearly identifying by highlighting, underlining or clouding the items to be reviewed, or crossing out the items which are not applicable.
- 1.3.4 Not including actual manufacturer's catalog information of proposed products.
- 1.3.5 Do not include multiple manufacturers for similar products and do not indicate "or approved equal" statements, or "to be determined later" statements. The products being submitted must be the products installed.

## PRODUCT SUBSTITUTION

- 1.4 All substitutions or alternate fixtures to those indicated on the project fixture schedule shall be submitted for approval (7) business days prior to the project bid date. Approvals <a href="when accepted will be issued in the form of an addendum.">when accepted will be issued in the form of an addendum.</a> No consideration for substitutions will be provided after the award of the contract.
  - 1.4.1 The substitution request must include a statement indicating the difference in price of both the specified and alternate product, both contractor and list price. The substitution request must include a comparison of the total fixture wattage, total fixture lumens, fixture efficiency and warranty comparison.



1.4.2 When proposing to substitute lighting fixture and/or fixture retrofit, a point by point photometric calculation of a typical application as used in this project shall be included. A calculation of the specified and the proposed alternate shall be included.

### PART 2 - PRODUCTS

- 2.1 All catalog numbers are given for manufacturer's identification and shall not relieve Contractor from responsibility of full conformance to all applicable written description requirements governing material and fabrication, either in the general or specific sections. Where catalog numbers are indicated as modified, no modification will be required if the standard unit fully conforms to descriptive requirements in the Specifications and matches specified ceiling.
- 2.2 All fixtures of the same type shall be of one manufacturer and of identical finish and appearance. All fixtures and component parts shall bear the UL label.
- 2.3 All steel parts shall be phosphate treated in multistage power spray system for corrosion resistance and paint adhesion. Final finish shall be electrostatically applied baked white enamel of not less than 87 pct. reflectance on reflecting surfaces.
- 2.4 Each fixture shall have a continuous light-seal gasket seated in such manner as to prevent any light leak through any portion or around any edge of the trim frame.
- 2.5 Diffusers shall be framed in a hinged, continuous assembly. Diffuser frame latches shall be spring-loaded or cam-operated.
- 2.6 All recessed fixtures shall be provided with frames appropriate for the type of ceiling involved. No fixtures shall be ordered until the ceiling construction has been verified by the Contractor.

# MINIMUM LUMINARY REQUIREMENTS

- 2.7 Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.
- 2.8 Recessed Fixtures: Comply with NEMA LE 4.
- 2.9 CRI of minimum 80 CCT of 4100 K.
- 2.10 Rated lamp life of 50,000 hours minimum.
- 2.11 Lamps dimmable from 100 percent to 0 percent of maximum light output.
- 2.12 Nominal Operating Voltage: 120 V / 277 V ac

# PART 3 – EXECUTION



- 3.1 All lighting fixtures shall be supported as follows:
  - From the outlet box by means of a metal strap where its weight is less than five pounds.
  - 3.1.2 From its outlet box by means of a hickey or other threaded connection where its weight is from five to fifty pounds.
  - 3.1.3 Directly from the structural slab or joists where its weight exceeds fifty pounds.
  - 3.1.4 Lighting fixtures shall be supported independent of the ceiling system or additional ceiling support must be added to carry the weight of the lighting fixtures. Recessed lighting fixtures supported from ceiling grid tees shall be furnished with hold down clips in conformance with CEC 410 - 16, spring clips will not be permitted. All fixtures which the manufacturer has not provided UL approved clips, must be attached to the fixture and ceiling grid by metal screws.
- 3.2 Furnish and install supplementary blocking and support as required to support fixture from structural members. Contractor shall submit proposed blocking method for all suspended lighting fixtures for approval prior to rough in.
- 3.3 Suspended and/or pendant mounted fixtures shall be provided with four aircraft safety cables extending in opposite directions, attached to the fixture, and supported from a structural member. The contractor shall submit proposed fixture mounting and aircraft cable attachment methods for approval prior to fixture rough in.
- 3.4 Chain suspension may be used only where specifically permitted on the drawings. Chain shall be heavy duty, nickel or cadmium plated, suitable for weight of specific fixture.
- 3.5 Shop drawings shall be furnished for each fixture type. Catalog cuts, illustrating conformance with specifications, will be acceptable for standard units. Shop drawings shall indicate materials, assembly, finish and dimensions.
- 3.6 Photometric data shall be furnished for any fixture substituted for those listed on the schedule.
- 3.7 Any driver which produces a greater than normal amount of noise shall be replaced by the contractor. Normal will be determined by the level of sound produced by other similar fixtures operating in the area.

# **END OF SECTION**



# **SECTION 26 90 90**

#### **TESTING**

# PART 1 – GENERAL

- 1.1 Upon completion of the electrical work, the entire installation shall be tested by the Contractor, and demonstrated to be operating satisfactorily to the Architect, Engineer, Inspector and Owner.
- 1.2 All testing and corrections shall be made prior to demonstration of operation to the Architect, Engineer, Inspector and Owner.
- 1.3 In addition to the demonstration of operation, the Contractor is also required to review the content and quality of instructions provided on items demonstrated with the Architect, Engineer, Inspector and Owner.

# PART 2 - EXECUTION

- 2.1 Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from "grounds," "short circuits," and any or all defects.
- 2.2 Motors shall be operating in proper rotations, and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed, and all other electrical equipment for proper operation.
- 2.3 Tests and adjustments shall be made prior to acceptance of the electrical installation by the Architect, and a certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided.
- 2.4 All equipment or wiring provided which tests prove to be defective or operating improperly shall be corrected or replaced promptly, at no additional cost to the Owner.
- 2.5 Test all motor and feeder circuits with a "megger" tester to determine that insulation values conform to Section 110-20, California Electrical Code (CED). Test reports must be submitted and approved by the engineer before final acceptance.
- 2.6 Test all grounding electrode connections to assure a resistance of no more than 10 ohms is achieved. Augment grounding until the ohmic value stated above is achieved. Provide certified test results to the Architect, Engineer and Inspector.

## **END OF SECTION**



## **SECTION 27 05 00**

# REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

## PART 1 - GENERAL

#### 1.01 SUMMARY

## A. Section Includes:

- 1. Provide a standard defining the structured communications cabling systems to be installed within customer facility. The goal is to accomplish this in the most economic and systematic fashion possible, and in a manner compliant with the latest codes, cabling standards and industry best practices.
- 2. Scope of Work Compliance.
- 3. Sub-contractor Qualifications.
- 4. Warranty.
- 5. Safety.
- 6. Working Conditions.

# 1.02 GENERAL TERMS AND CONDITIONS.

- A. General Contractor is responsible for all required Division 27 scope of work and shall ensure all communication sub-tier sub-contractors adhere to the qualifications set forth in all project Division 27 specifications including project experience and certifications.
- B. Prices quoted shall be all-inclusive and represent a complete fully-engineered system installation at the Project site as contemplated by and detailed in the drawing package and in accompanying specifications.
- C. Omissions in the specification of any provision herein described shall not be construed as to relieve the sub-contractor of any responsibility or obligation requisite to the complete and satisfactory delivery, installation, operation and support of any and all systems, equipment or services. Correction of any omission on the part of the Subcontractor, either due to misinterpretation of this specification or any other conditions of the project, shall be the responsibility of the Sub-contractor and shall not result in any contract modification or additional costs to Owner.
- D. Where conflicts and/or irregularities occur between project documents, specifications, drawings, and/or applicable codes, rules, regulations, ordinances, standards, guidelines and practices, the more stringent requirement shall apply as reasonably determined by Owner or government agency inspector.
- E. This specification represents the design intent for the project communicated by way of narrative descriptions of intended functionality and single line or detail drawings indicating likely equipment connectivity to achieve that functionality. The designs in this specification do not represent fully engineered technical solutions. Sub-contractors are required to review the designs presented in the project documents closely, submit any questions and clarifications regarding the design intent through the RFI process and develop their own engineered solutions representing a fully functional turn-key solution in their bid responses.



- F. The scope of this project includes the complete system engineering, procurement, fabrication, installation, programming, testing, training and warranty.
- G. Proposed solutions shall be based on the designs communicated in the specifications, but shall include any additional equipment, materials, software, licenses and/or labor required for the sub-contractor to deliver a fully functional turn-key system solution that meets intended operational performance requirements.
- H. It is the responsibility of the Sub-contractor awarded this project to ensure that all quantities, materials, labor, licenses, permits, sales taxes and any and all other costs to provide a turnkey project are included in their bid.
- I. Floor plans, drawings, elevation drawings, and other drawings received by the Sub-contractor as part of the construction process are hereby incorporated into this document by reference. It is the responsibility of the Sub-contractor to ensure that amounts and lengths of cabling and pathways are correct, and that all materials and labor are included to install the system per the drawings and these specifications.
- J. Permits, licenses, applicable sales taxes, insurance requirements, payment/performance bond costs, and other miscellaneous costs are the responsibility of the Sub-contractor and must be included in the contract price and this scope of work. Such items are to be listed separately on pricing sheets, if provided. Copies of all required permits, licenses, insurance requirements and bond(s) are to be delivered to Owner prior to commencement of any work.
- K. Installation Schedule and Coordination: Sub-contractor must take the fast-track nature of this project and potential requirement for installation/work schedule adjustments and quick turnarounds into consideration in constructing this project as Owner will NOT entertain or agree to added-cost change orders associated with scheduling changes.
- L. Work will need to be closely coordinated with architect, College Personnel, GC, MEP sub-contractors, structural sub-contractor and all low-voltage sub-contractors and each of their respective schedules.
- M. This will be a turnkey Project. Any item of the equipment or material not specifically addressed on the drawings, specifications or elsewhere in Division 27 specifications documents, but required to provide complete and functional systems as contemplated and/or specified herein, shall be provided at no additional charge to owner in a quantity and quality consistent with other specified items.
- N. Coordination with Project Design Team: The build sub-contractor will be responsible for coordinating all communications cabling infrastructure requirements, including review of existing site conditions, review and coordination of electrical power and grounding requirements, conduits and back boxes, structural support requirements, and coordination.
- O. Assembly: The sub-contractor shall procure and assemble all hardware and equipment and any additional materials as required to deliver the completely functioning communications cabling system and/or Audio Visual System.



- P. Installation: The sub-contractor shall install all equipment, inter-rack and intra-rack cable, wiring of equipment, connectors, panels, plates, and other material at the Project site.
- Q. Testing and Adjustment: The sub-contractor shall perform all tests and adjustments, furnish all test equipment necessary and perform all work required to properly configure the systems and to verify their performance in accordance with the information in this document and the design-build integrator's approved engineered designs.
- R. Warranty: The sub-contractor shall warrant the installed system in accordance with the terms of this document and accompanying contractual documents.

# 1.03 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings including but not limited to Telecommunication Drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

#### 1.04 REFERENCES

A. Abbreviations and Acronyms:

1. A/E: Architect / Engineer (designer)

2. BICSI: Building Industry Consulting Service International

EIA: Electronics Industry Alliance
 ELFEXT Equal Level far End Cross Talk

5. FTP Foiled Twisted Pair

6. IDF: Intermediate Distribution Facility7. ILEC/LEC: Incumbent Local Exchange Carrier

8. ISP: Inside Plant

IT: Information Technology
 MDF: Main Distribution Facility
 MPOE: Minimum Point of Entry
 NEXT Near End Cross Talk

13. OSP: Outside Plant

14. PSELFEXT: Power Sum Equal Level far End Cross Talk

15. PSNEXT: Power Sum Near End Cross Talk

16. RCDD: Registered Communications Distribution Designer

17. TBD: To Be Determined

18. TCIM: Telecommunication Cabling Installation Manual19. TDMM: Telecommunications Distribution Methods Manual

20. TIA: Telecommunications Industry Association

21. UTP: Unshielded Twisted Pair22. WAP: Wireless Access Point.



## 1.05 APPLICABLE REGULATORY REFERENCES

- A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
  - ANSI/TIA:
    - TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
    - b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
    - c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
    - d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
    - e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
    - f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
    - g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
    - h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
    - i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
    - j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
    - k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
    - ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
    - m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
    - n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
    - o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 Cabling Guidelines for Data Center Fabrics
    - p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
    - q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
    - r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
    - s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
    - t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises External Grounding Addendum



- u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
- x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
- z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
- aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 Industrial Pathways and Spaces
- bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

# 2. ISO/IEC

- a. ISO 11801 (November 2010) Generic Cabling for Customer Premises
- b. ISO/IEC TR 14763-2-1:2012 Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation Identifiers within administration system.
- National Electric Codes
  - a. National Electrical Code (2017)
  - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
  - c. ANSI/IEEE C2-207, National Electrical Safety Code®
  - d. National Electrical Code (NEC) (NFPA 70)
- 4. OSHA Standards and Regulations all applicable
- 5. Local Codes and Standards all applicable
- 6. BICSI
  - a. Telecommunications Distribution Methods Manual, 13th Edition
  - BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
  - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
  - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
  - e. Network Systems and Commissioning (NSC) reference, 1st Edition
  - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
  - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
  - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
  - i. AV Design Reference Manual, 1st Edition
  - j. Network Design Reference Manual, 7th Edition
  - k. Outside Plant Design Reference Manual, 5th Edition
  - I. Wireless Design Reference Manual, 3rd Edition
  - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- 7. Anywhere cabling Standards conflict with electrical or safety Codes, Subcontractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.



- Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
- 9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

## 1.06 SCOPE OF WORK

# A. General project information:

- These Specifications and associated drawings are the governing document for the installation of the telecommunications infrastructure and includes project descriptions, specified and recommended products, installation and project management methods, the scope of work and elevation drawing specifications.
- 2. Through this division specification document, Palomar College will be referred to as the owner.
- 3. Owner wishes to contract with a General Contractor, who will sub-tier the supplier/sub-contractor ("ICT-Information and Communication Technology and AV-Audio Visual") to provide, install, test and warranty a complete turn-key Cable Infrastructure System and PA System for Owner's new North Education Center (NEC) the "Project" per the scope of work and specifications stated herein. This inquiry implies no obligation on the part of Owner. Sub-contractor shall bear all costs and expenses incurred in preparing a response a Request For Proposal ("RFP") and subsequent award of project, it being understood and agreed that Owner accepts no responsibility for any costs and/or expenses incurred by winning sub-contractor in preparing and submitting such response.
- 4. The Owner is developing a new multi-building Classroom village located at 35090 Horse Ranch Creek Road, Fallbrook, CA 92028. The NEC will be a newly developed site with 3 phasesn Phase 2, 3 and 4. Phase 2 will include site utilities/systems and parking lots. Phase 3 and 4 will include four (4) banks of multiple modular buildings. The (4) banks includes modulars consisting of the following:
  - a. Phase 3 Administration modular building with College office space and student shared areas. The Administration Building will house the NEC MPOE/Server Room, supporting the NEC network requirements.
  - b. Phase 3 General Classroom Modulars which will include one of the two village IDF's.
  - c. Phase 3 Lecture, Computer Lab, Library and General Classroom modular buildings. These areas will consist of multiple double wide and single wide modular buildings. This area will include the second of the two village IDF's.
  - d. Phase 4 Science Lab modular buildings with include two science labs and one lab prep room. All cabling from these modular buildings will be ran to IDF located with-in the General Classroom bank of modular buildings. See design drawings for reference.
- 5. The scope of work will include a complete AFL Dura-Line fiber optic air blown fiber system and category backbone between each of the IDF's and the main server room. Each building will have a Category 6A cable infrastructure and specialized PA cabling as required.
- 6. Contractor shall build out each MDF, IDF as shown on drawings. Administration Building will consist of a Main Server Room. Total of 3 communication rooms.
- 7. Station cable pathway will consist of cable J-hook in accessible ceilings areas or conduit to accessible ceiling areas.



- 8. Communication Outlet (Split delta) =In areas where cable will be installed in non-exposed format, electrical contractor shall provide 5" square deep junction box inside wall with single gang plaster ring and 1.25" conduit routed to accessible ceiling space. Cabling shall be run to the nearest TR. Outlet shall be mounted + 18" AFF (U.N.O.). Each outlet location shall have three (2) Category 6A, 4-pair cables and three (2) Category 6A, RJ-45 jacks (U.N.O.). Jacks shall be housed in a standard angled four port single gang wall faceplate with matching blanks for used ports. Color to match the wall paint color as close as possible. Wall plate color will be approved by architect prior to installation of faceplate.
- 9. Communication Outlet (Split delta) w/# =In areas where cable will be installed in non-exposed format, electrical contractor shall provide 5" square deep junction box inside wall with single gang plaster ring and 1.25" conduit routed to accessible ceiling space. Cabling shall be run to the nearest TR. Outlet shall be mounted + 18" AFF (U.N.O.) Each outlet shall have a category 6A, 4-pair cables and a category 6, RJ-45 jacks per the number indicated on the drawings. (#6=6 cables/Jacks) Jacks shall be housed in a standard angled four port single gang wall faceplate with matching blanks for used ports. Color to match the wall paint color as close as possible. Wall plate color will be approved by architect prior to installation of faceplate
- 10. Flush floor mounted outlet (split delta with-in square) = electrical contractor shall provide two 1-1/4" conduit routed to accessible ceiling space Electrical contractor shall provide floor box with cover flush in the floor, fire sealing, conduit pathway and pull string. Communication contractor shall provide all cable and connectivity hardware. Cabling shall be run to the TR location as indicated on the drawings. Each outlet shall have a category 6A, 4-pair cables and a category 6, RJ-45 jacks per the number indicated on the drawings. For conference room, office locations, or any floor boxes not showing a number next to the symbol, Communication contractor shall provide four (2) Category 6A MTP cables and four (2) Category 6A RJ-45 jacks mounted inside the floor box. Blank off all unused ports. Communication contractor is responsible to provide faceplate inside floor box.
- 11. Installation of Copper UTP Category 6A cabling as indicated on drawings.
- Provide fiber optic, category patch cables and copper cross connections for both ends of communication link. Patch cable installation will be part of this scope of work.
- 13. Install 6 strand Single-Mode optical fiber air-blown backbone cabling backbone cable between MDF and each Building IDF room as indicated on drawings. MDF will act as MPOE.
- Install Category 6 OSP backbone cabling between MDF and each Building IDF room as indicated on drawings.
- 15. Sub-contractor shall provide proper slack loops in each communication vault, minimum of 50' and a minimum of 15' in pull boxes, slack loops required only if they will meet manufacturer bend radii requirements.
- 16. Sub-contractor shall provide/install fire caulk in all conduits with cable as required, UL listed rated fire system where applicable.
- 17. Sub-contractor shall label all new cable at both termination points, within all communication vaults and/or pull boxes. Cable bundles shall be labeled where ever it is accessible including origin/destination and system information.

## B. Purpose:

 This specification defines quality standards and practices common to all network cabling for NEC project. In addition, said project will have Requests for Proposals



- (RFP), associated drawings and requirements pertaining to their specific environments. Such collateral will be referred to in this document as "Project Specific Documentation" or simply "Construction Documents".
- Voice and Data Networks encompass a broad spectrum of technologies and are distributed into project internal spaces. Installed cables will be used for Ethernet, high and low speed data applications, used in analog and digital voice, not to exclude other future Voice/Data technologies. This specification will include indoor/outdoor cable installations, and backbone cabling, telecommunications closet and equipment cabling, equipment hardware as well as routing and support infrastructure.
- 3. It is the responsibility of the installing sub-contractor to evaluate these general recommendations and adapt them effectively to actual projects. Sub-contractor is responsible for identifying and bringing to the attention of any design directions that may be in conflict or otherwise improved. All such conflict resolutions shall be in writing from A/E or owner.
- 4. Note that while many portions of this global specification are addressed to "The Sub-contractor", these requirements apply equally to anyone doing the network cabling and infrastructure work within, whether those persons are outside sub-contractors or persons directly employed by the owner.
- 5. Sub-contractor shall be solely responsible for all parts, labor, testing, documentation and all other associated processes and physical apparatus necessary to turn-over the completed system fully warranted and operational for acceptance by A/E.
- 6. This specification includes structured cabling design considerations, product specifications and installation guidelines for low-voltage network systems and associated infrastructure including, but not limited to:
  - a. Cabling Sub-system 1 Horizontal
    - 1) Category 6A cable
    - 2) Work area (equipment outlet) appliances and configuration
    - 3) Horizontal Pathways
    - 4) Copper Patching
  - b. Fiber Backbone Cabling
    - 1) Interbuilding backbone
    - 2) Fiber Patching
  - c. Telecommunications Spaces
    - 1) Telecommunications Room Requirements
    - 2) Racks and Cabinets
    - 3) Overhead Pathways
  - d. Communications Grounding Systems
  - e. Communications Labeling and Administration

# C. Scheduling:

- Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.
- 2. New NEC project schedule will include, but are not limited to, the following task sequence:



- Conduit infrastructure; including vaults/pullbox install and conduit duct banks.
- b. New MDF, IDF Construction and buildout.
- c. Service provider cabling and equipment installation.
- d. Service provider completion and commissioning.
- e. Individual Building Pathway Installation.
- f. New backbone fiber optic cabling installations; includes install, termination, labeling, testing, as-built and warranty documentation.
- g. Building Category and AV Cable installations; includes install, termination, labeling, testing, as-built and warranty documentation.
- h. Audio Equipment installation.

#### 1.07 SUB-CONTRACTOR QUALIFICATIONS

#### A. General:

- 1. Sub-contractor shall have at least 5 years of experience installing and testing structured cabling systems.
- 2. Sub-contractor shall employ at least one BICSI Registered Communication Distribution Designer (RCDD), and the RCDD shall sign-off on all designs offered, including stamping the design with their current BICSI/RCDD stamp.
- 3. Sub-contractor shall have the responsibility to obtain any of the necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.
- 4. Contactor shall be a current manufacturer Certified Installer certificate. A copy of corporate certificate must be included with quote.
- 5. Sub-contractor shall have service facilities within 50 miles of project location.
- 6. At least 75 percent of the technicians on the job must have a current manufacturer Certified Copper Technicians certificate to install manufacturer Copper Distribution Systems.
- 7. At least 75 percent of the technicians installing any Fiber Distribution Systems must have a current manufacturer Certified Fiber Technicians certificate to install Fiber Distribution Systems.
- 8. The Telecommunications sub-contractor must provide a project manager to serve as the single point of contact to manage the installation, speak for the sub-contractor and provide the following functions:
  - a. Initiate and coordinate tasks with the Construction Manager and others as specified by the project schedule.
  - b. Provide day to day direction and on-site supervision of Sub-contractor personnel.
  - c. Ensure conformance with all contract and warranty provisions.
  - d. Participate in weekly site project meetings.
  - e. This individual will remain project manager for the duration of the project. The sub-contractor may change Project Manager only with the written approval of A/E.

## B. References:

 Communications Sub-contractor shall provide with bid a list of three reference accounts where similar Data, Voice, Fiber Optic Cable, and related migration/cutover equipment installation work was performed within the last year or twelve-month period.



# C. Insurance Requirements:

- Sub-contractor must be insured and shall provide with bid a Certificate of Indemnification, Certificate of Insurance, and meet all required insurance and licensing policies as specified by A/E Risk Management Division and any Federal, State, and local organization pertaining to data, voice and fiber optic cable installation.
- 2. Sub-contractor's vehicles brought onto project properties, shall comply with all requirements of all Federal, State, and local agencies. Vehicles shall meet current DOT, state and local, safety inspections where required.

# D. Termination of Services:

- Owner or A/E reserves the right to terminate the Communication Sub-contractor's services if at any time the A/E determines the Communication Sub-contractor is not fulfilling their responsibilities as defined within this document.
- 2. Sub-contractor's appearance and work ethics shall be of a professional manner, dress shall be commensurate with work being performed.
- 3. Dress displaying lewd or controversial innuendos will strictly be prohibited.
- 4. Conduct on project property will be professional in nature.
- 5. Any person in the Sub-contractor's employ working on a project considered by to be incompetent or disorderly, or for any other reason unsatisfactory or undesirable, such person shall be removed from work on the project.
- 6. The Communications Sub-contractor shall be restricted from the premises and compensated for the percentage of work completed satisfactorily.

# E. Other Sub-Contractor Responsibilities

- Sub-contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job. All work areas will be cleaned at the conclusion of the workday and no tools or materials shall be left in a manner as to pose a safety hazard.
- 2. Sub-contractor must remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. This is mandatory; Sub-contractors must consider this when placing bids.
- 3. Sub-contractor shall abide by the regulations set by A/E or Owner Security Department pertaining to access to and conduct while on project property and shall obey speed limits and parking regulations.

# 1.08 SYSTEM PERFORMANCE WARRANTY

# A. General

- 1. Sub-contractor shall provide a manufacturer System Warranty on all copper and fiber permanent cabling links.
- 2. This is a system performance warranty guaranteeing for a minimum of 20 years from acceptance that the installed system shall support all data link protocols for which that copper Category or fiber OS designation is engineered to support according to IEEE and TIA standards.
- 3. The manufacturer System Warranty may be invoked only if the cabling channel links are comprised of manufacturer connectivity and approved by the manufacturer. Patch cords must be same manufacturer of cable.
- 4. Upon acceptance of Warranty, manufacturer will mail a notification letter to the installer and a notification letter and warranty certificate to A/E.



# B. Sub-Contractor Warranty Obligations

- 1. Installation firm must be a current manufacturer Certified Installer in good standing and shall include a copy of the company certification with the bid.
- 2. Sub-contractor shall name a supervisor to serve on site as a liaison responsible to inspect and assure all terminations are compliant to factory methods taught in manufacturer Technician Certification Training and according to all Standards cited in the Regulatory References section of this document.
- 3. Sub-contractor liaison shall have a current, up-to-date manufacturer Certified Technician certificate in both copper and fiber. Copies of the copper and fiber certificates of the manufacturer liaison shall be submitted with the bid.
- 4. Sub-contractor agrees all components comprising active links shall be of the same copper Category or fiber OS/OM designation as the system being installed. Sub-contractor shall under no circumstances mix different Categories or OS classes of cable or termination devices (connectors) within the same link or system.
- 5. Sub-contractor shall install all racking and support structures according to cited TIA Standards in such fashion as to maintain both Standards and Manufacturer recommendations for uniform support and protection, segregation of different cable types, maintenance of maximum pulling tensions, minimum bend radius, approved termination methods as well as adhering to industry accepted practices of good workmanship.
- 6. Sub-contractor is responsible for understanding and submitting to manufacturer all documents required prior to project start to apply for this warranty. These include but are not limited to the project information form and SCS warranty agreement.
- 7. Sub-contractor is responsible for understanding and submitting to manufacturer all documents required at project end. These include completed warranty forms, passing test reports and drawings of floor plans showing locations of links tested.
- 8. Test results shall be delivered in the tester native format (not Excel) and represent the full test report. Summaries shall not be accepted. Contact manufacturer for a current list of approved testers, test leads and latest operating systems.
- 9. The Communications Sub-contractor will correct any problems and malfunctions that are warranty-related issues without additional charge for the entire warranty period. The warranty period shall commence following the acceptance of the project by A/E and written confirmation of Warranty from manufacturer.

## 1.09 SAFETY

#### A. General

- All cabling work being performed on project property or under contract to Technology Department must comply with Rules for safe operations, any state or local safety regulations and meet the requirements of OSHA Safety and Health Standards. The sub-contractor Project Manager will maintain a copy of Rules for Safe Operations for reference. It is the responsibility of the Communications Sub-contractor to immediately correct any unsafe working practices on the part of sub-contractor personnel. Unsafe working environments or conditions created by sub-contractor personnel will be reported immediately to the Construction Manager.
- 2. Any liability for correction of conditions created by the sub-contractor's personnel rests with the sub-contractor.
- 3. The Communications Sub-contractor shall be solely and completely responsible for conditions of the job site (as pertaining to the materials and equipment specified), including safety of persons and property during performance of work.



4. No act, service, drawing review or construction observance by any employee, representative or engineer may be construed as a review or approval of the adequacy of the Sub-contractor(s) safety measures, in, on, or near the construction site.

#### 1.10 WORKING CONDITIONS

## A. Site Access

- 1. All cable installations must be pre-approved by the Construction Manager to ensure that the necessary arrangements have been made for proper access to project sites.
- 2. A twenty-four-hour prior notice shall be submitted to the Construction Manager for any work schedule changes.
- 3. Communications Sub-contractor shall display badges or passes as mandated by project property Security Department Rules and Regulations.

# B. Scheduling

- Coordination of site surveys and the issue of project owner owned materials and equipment will be the responsibility of the Construction Manager. Once said equipment and materials are in the Sub-contractor's possession, it is the Subcontractor's to safeguard the material and equipment from damage or theft.
- 2. Information required by the Sub-contractor to price and complete a defined scope of work will be furnished to the Communications Sub-contractor by the A/E Project Manager in a Scope of Work document and at the time of the site survey (if necessary) and will be maintained by the Communications Sub-contractor until the completion of the job.
- 3. It is the Sub-contractor's responsibility to begin work promptly according to the Start Dates and to complete work by the Proposed Completion Date listed on the Cable Run Request Form.
- 4. The Sub-contractor must notify the Construction Manager in writing of any delays; at that time, they shall come up with a mutually agreeable project schedule.
- 5. The Communications Sub-contractor will coordinate with the Construction Manager working hours and job site access issues.
- 6. The Communications Sub-contractor will coordinate with the Construction Manager to minimize outages to the existing systems.
- 7. Any service interruption required by the Communications Sub-contractor must be requested in writing, and scheduled with the Construction Manager.
- 8. The Communications Sub-contractor shall not proceed with the requested service interruption until written approval is granted by the Construction Manager.
- 9. All problems, and questions relating to a particular job, will be referred to the Construction Manager and no changes shall be made without his/her written approval.

# C. Harmony Clause

1. Sub-contractor shall coordinate and work in harmony with other trades on the project as well as with A/E personnel.

## 1.11 COORDINATION

A. Coordinate layout and installation of voice, data, and video communication cabling with other sub-contractors and equipment suppliers.



- Meet jointly with other sub-contractors, equipment suppliers, and representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
- 2. Record agreements reached in meetings and distribute to other participants.
- 3. Adjust arrangements and locations of distribution frames, cross-connect and patch panels in equipment rooms and telecommunications rooms to accommodate and optimize arrangement and space requirements of voice and LAN equipment.
- 4. When indicated on drawings, sub-contractor shall reuse existing copper and fiber optic backbone cables.
- 5. Provide weekly progress reports and crew schedules to project representatives by 5:00 PM. Thursday of each project work week.

#### 1.12 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
  - Submit all product data in accordance with general requirements of the construction documents.
  - 2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
  - 3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
  - 4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

# 1.13 Information & COmmunication Technology (ICT) components

- A. The Contract Documents generally outline industry standard components to be installed as part of the project ICT installation requirements. Such identification is intended to be general in nature rather than exhaustive. All stated quantities are subject to validation by ICT Sub-contractor. ICT Sub-contractor is reminded that differences between estimated quantities and those reasonably derived based from the Contract Documents (as well as through bid conferences, job walks, addendums, and other distribution of information) shall be the responsibility of the ICT Sub-contractor. There shall be no additional cost incurred by Palomar College NEC project for not complying with the specifications and requirements of the Contract Documents.
- B. Any variance from those components identified on the drawings and/or below shall be submitted to Palomar College NEC project representatives for approval prior to ordering and installation; the risk for all costs incurred by the ICT Sub-contractor for materials ordered prior to such written approval shall be borne entirely by the ICT Sub-contractor. Nonetheless, it is imperative that the ICT Sub-contractor determine the availability of necessary materials and propose equivalent substitutes as necessary to meet all installation milestones. Delays in ICT installations due to lack of product availability are unacceptable. As catalog numbers change frequently, the ICT Sub-contractor must verify all part numbers prior to ordering materials. Clarifications will be issued in response to written Requests for Information (RFI).



- C. All new fiber optic cabling, will be Air-Blown Fiber indoor/outdoor rated. Any unrated cable (such as filled ASP) shall not be installed within the structure except when placed within IMT, PVC or RGS conduit.
- D. Throughout this specification, Dura-Line, Berk-Tek, Leviton, Chatsworth Products, Inc. and other manufacturers are cited. These citations are for the purpose of establishing quality, performance, warranty certification criteria and are campus standards.

# 1.14 DELIVERY AND STORAGE

- A. ICT Sub-contractor shall provide a materials schedule prior to the start date of cable installation. Material schedule shall specify all material quantities and their delivery date for this project.
- B. ICT Sub-contractor shall provide protection from weather, moisture, dirt, dust and other contaminants for telecommunications cabling and pathway equipment placed in storage.

## 1.15 INFORMATIONAL SUBMITTALS

# A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

# B. Certificates:

- 1. Submit management and installation team reference documentation verifying:
  - a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
  - b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents.

#### C. Qualification Statements:

 The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

## 1.16 CLOSEOUT SUBMITTALS

# A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
- 2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference.
- 3. Communication sub-contractor to print, frame and mount approved as-built drawings in MPOE. Coordinate location with A/E.



# 1.17 QUALITY ASSURANCE

- A. Qualifications Manufacturer
  - Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.
- B. Qualifications Installer:
  - At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

# PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

# 3.01 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

# 3.02 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

## 3.03 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

## **END OF SECTION**



## **SECTION 27 05 33**

# **CONDUITS AND BOXES FOR COMMUNICATIONS SYSTEMS**

## PART 1 - GENERAL

## 1.01 SUMMARY

- A. Section Includes:
  - Provides specifications for conduit pathways, back boxes and pull box enclosures utilized for the distribution and housing of telecommunications cabling and components:
  - 2. Telecom EMT conduit and boxes

# 1.02 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

# 1.03 REFERENCES

- A. Abbreviations and Acronyms:
  - 1. A/E: Architect / Engineer (designer)
  - 2. ANSI: American National Standards Institute
  - 3. AHJ: Authority Having Jurisdiction
  - 4. BICSI: Building Industry Consulting Service International
  - 5. EIA: Electronics Industry Alliance
  - 6. TDMM: Telecommunications Distribution Methods Manual
  - 7. TIA: Telecommunications Industry Association
  - 8. UL: Underwriters Laboratory
- B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.
  - 1. National Electric Safety Code (NESC) 2017
  - 2. National Fire Protection Association (NFPA)
  - 3. 2017 California Electrical Code
  - 4. 2017 California Building Code
  - 5. Local Municipal Codes

## 1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.



## ANSI/TIA:

- a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
- d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
- e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
- f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
- g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
- h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
- i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
- j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
- k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
- ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
- m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
- n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
- ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
- p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
- TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
- r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
- s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises External Grounding Addendum
- u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.



- x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
- z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
- aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 Industrial Pathways and Spaces
- bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

## 2. ISO/IEC

- a. ISO 11801 (November 2010) Generic Cabling for Customer Premises
- b. ISO/IEC TR 14763-2-1:2012 Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation Identifiers within administration system.
- 3. National Electric Codes
  - a. National Electrical Code (2017)
  - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
  - c. ANSI/IEEE C2-207, National Electrical Safety Code®
  - d. National Electrical Code (NEC) (NFPA 70)
- 4. OSHA Standards and Regulations all applicable
- 5. Local Codes and Standards all applicable
- 6. BICSI
  - a. Telecommunications Distribution Methods Manual, 13th Edition
  - BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
  - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th
  - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
  - e. Network Systems and Commissioning (NSC) reference, 1st Edition
  - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
  - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
  - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
  - i. AV Design Reference Manual, 1st Edition
  - j. Network Design Reference Manual, 7th Edition
  - k. Outside Plant Design Reference Manual, 5th Edition
  - I. Wireless Design Reference Manual, 3rd Edition
  - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- 7. Anywhere cabling Standards conflict with electrical or safety Codes, Subcontractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- 8. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
- 9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.



## 1.05 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

## B. Scheduling:

 Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

## 1.06 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
  - Submit all product data in accordance with general requirements of the construction documents.
  - 2. Submit product cut sheets and a detailed list of components a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
  - 3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
  - 4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

# 1.07 INFORMATIONAL SUBMITTALS

## A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

# 1.08 CLOSEOUT SUBMITTALS

# A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
- 2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

CONDUITS AND BOXES



## PART 2 - PRODUCTS

## 2.01 CONDUIT AND BACKBOXES

- A. EMT conduit
  - 1. Wheatland Tube
  - 2. Appleton
  - 3. Crouse-Hinds
  - 4. Or equal.
- B. PVC conduit
  - 1. JM Eagle
  - 2. Electro Flex
  - 3. Or equal
- C. Pull boxes
  - 1. Hoffman Engineering Co,
  - 2. Or equal.
- D. Back Boxes
  - 1. Randl Industries 5 Square Outlet Box- 2.875 Deep with Management
    - a. Part Number T-55017

# 2.02 TELECOMMUNICATIONS CONDUIT AND BACKBOXES

- A. Electrical Metallic Galvanized Tubing and Fittings with natural finish for all conduits not exposed: ANSI C80.3 with compression-type fittings.
- B. Indoor Pull boxes: Galvanized steel, screw cover pull box. Grey polyester powder coat finish inside and out. NEMA Type 1. Pull boxes to be sized per NEC code to accommodate the number of EMT conduits as shown on Telecom drawings with adequate clearances, access and cable management space.

# PART 3 - EXECUTION

# 3.01 EXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

#### 3.02 INSTALLATION

- A. Pull boxes:
  - 1. Install Pull boxes in easily accessible locations.
  - 2. Install Horizontal cabling boxes immediately above suspended ceilings.
  - 3. A pull box should not be used in lieu of a bend.
  - 4. Conduits that enter the pull box from opposite ends with each other should be aligned.



5. For direct access to a box located above inaccessible ceilings provide a suitable,

Conduit	Pull box	Pull box	Pull box	Pull box Width
Trade				for Additional
Size	Width (in.)	Length (in.)	Depth (in.)	Conduit
1	4	16	3	2
1	6	20	3	3
1	8	27	4	4
2	8	36	4	5
2	10	42	5	6
3	12	48	5	6
3	12	54	6	6
4	15	60	8	8

marked, hinged access panel (or equivalent) in the ceiling. This access panel can also serve as the cover for the box.

6. Pull box sizing table:

## B. Back Boxes

- 1. Provide 4-11/16" H X 4-11/16" W X 2-1/8" D outlet back boxes at all telecom outlet locations shown on drawings. Provide (1) 1-1/4" conduit from back box to telecom room or pull box except as otherwise noted. All connectors and couplings shall be zinc-plated steel set screw type. Die cast zinc fittings are not to be used. Provide bushing on ends of all conduits. Provide pull string in all conduits.
- 2. Provide single gang plaster ring on all communications outlet back boxes, unless indicated otherwise.
- 3. Provide bonding to cable tray pathways.

# C. Conduit support and bracing:

- 1. Coordinate layout and installation of conduits and pull boxes with other trade conditions to ensure adequate clearances, access and cable management.
- 2. Install and provide support for EMT conduits and pull boxes in accordance with the latest edition of the NEC code, as well as all state and local codes and requirements. Coordinate installation and location with existing conditions. Notify and get the Owners Representative approval before installing conduits and pull boxes where the location need to deviate from the contract documents.
- 3. Install conduits above ceilings at height to provide access to pull. Install conduits and pull boxes level and square and at proper elevations. Ensure adequate clearances, access and cable management.
- 4. Use fittings and support devices compatible with conduits and pull boxes and suitable for use and location. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.
- Install individual and multiple trapeze hangers and riser clamps as necessary to support the conduits. Provide U-bolts, clamp attachments and other necessary hardware for hanger assemblies and for securing hanger rods and conduits. Space supports for conduits on maximum 10-foot centers.
- 6. Provide and install expansion or deflection fittings for conduits runs at all instances at seismic or expansion joints to allow for movement in any direction.

# D. Conduit routing, bends and radius guidelines:

1. If the conduit has an internal diameter of 2 inches or less the bend radius must be at least 6 times the internal conduit diameter.

CONDUITS AND BOXES



- 2. If the conduit has an internal diameter of more than 2 inches the bend radius must be at least 10 times the internal conduit diameter.
- 3. Conduit bends should be smooth, even, and free of kinks or other discontinuities that may have detrimental effects on pulling tension or cable integrity during or after installation.
- 4. If a conduit run requires more than two 90 degree bends then provide a pull box between sections with two bends or less.
- 5. If a conduit run requires a reverse bend (between 100 degrees and 180 degrees) then insert a pull point or pull box at each bend having an angle from 100 degrees to 180 degrees.
- 6. Consider an offset as equivalent to a 90 degree bend.
- 7. A pullbox shall not be used as a 90 degree bend.
- 8. Achieve the best direct route with no bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
- 9. Contain no continuous sections longer than 100 ft.
- 10. For runs that total more than 100 ft. in length, pull points or pull boxes should be inserted so that no segment between points/boxes exceeds the 100 ft. limit.
- 11. Withstand the environment to which they will be exposed.
- 12. Conduits should not be routed through areas in which flammable material may be stored or over or adjacent to boilers, incinerators, hot-water lines and steam lines.
- 13. Keep conduits at least 6' away from parallel runs of steam, hot water pipes or mechanical ductwork.

# E. Conduit Terminations

- 1. Join conduits with fittings designed and approved for the purpose. Make the joints tight without protruding lips that can snag cable pulling inside the conduits.
- 2. Where conduits are terminated with locknuts and bushings align the conduit to enter squarely and install the locknuts with dished part against the box. Use two locknuts, one inside and one outside the box.
- 3. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.
- 4. Conduits that enter a telecom room should terminate near the corners to allow for proper cable racking.
- 5. Terminate conduits that protrude through the structural floor 3 inches above the surface.
- 6. Maintain the integrity of all fire stop barriers for all floor or wall penetrations.
- F. Provide grounding and bonding for conduits and pull boxes as indicated by NEC code and instructed by manufacturer.
- G. Conduits shall be clearly labeled at both ends designating the opposite locations(s) served. The numbering scheme shall be room number plus a suffix to guarantee uniqueness, e.g., 143-1. Labeling must be machine generated.

## H. Conduit Protection:

- 1. Remove burrs, dirt and construction debris from conduits and pull boxes.
- 2. Conduits should be left capped for protection.
- 3. Provide final protection and maintain conditions in a manner acceptable to the Owners Representative to ensure that coatings, finishes and pull boxes are without damage or deterioration at completion. Repair damage to galvanized finishes with zinc-rich paint recommended by the manufacturer.

**CONDUITS AND BOXES** 



## 3.03 ACCEPTANCE

- A. All specified conduits and pull boxes indicated on the drawings and specifications shall be complete.
- B. Specified shop drawings and product submittals shall have been submitted for review and all review comments and deficiencies shall have been resolved. Final shop drawings and product submittals shall have been submitted, reviewed and found to meet the requirements of the specifications.
- C. Issues and deficiencies identified in field reports and punch lists shall have been resolved. Final as-built drawings shall have been submitted, reviewed and found to meet the requirements of the specifications.
- D. Sub-contractor shall provide written notice of final completion of the telecom infrastructure. Upon receipt, the Owner's Representative will review/observe the completed installation. Once the Owner's Representative is satisfied that all work is in accordance with the Contract Documents, the Sub-contractor will be notified in writing.

# 3.04 RE-INSTALLATION

- A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work
- B. CLOSEOUT ACTIVITIES
- C. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- D. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

## **END OF SECTION**



## **SECTION 27 05 53**

# **IDENTIFICATION FOR COMMUNICATIONS SYSTEMS**

## PART 1 - GENERAL

## 1.01 SUMMARY

## A. Section Includes:

- 1. Provides specifications information for identification of the various components of the telecommunications infrastructure and pathway system.
- 2. Labeling and identification.

# 1.02 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.
- C. Refer to Structural Seismic Requirement design documents Specifications, if available, for Non-Structural Components for all structural bracing and support of telecommunications equipment.

#### 1.03 REFERENCES

- A. Abbreviations and Acronyms:
  - 1. ANSI American National Standards Institute
  - 2. BICSI: Building Industry Consulting Service International
  - 3. EIA: Electronics Industry Alliance
  - 4. IDF: Intermediate Distribution Facility
  - 5. MDF Main Distribution Facility
  - RCDD: Registered Communications Distribution Designer
     TCIM: Telecommunication Cabling Installation Manual
     TDMM: Telecommunications Distribution Methods Manual
  - 9. TIA: Telecommunications Industry Association
- B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.
  - 1. National Electric Safety Code (NESC) 2017
  - 2. National Fire Protection Association (NFPA)
  - 3. 2017 California Electrical Code
  - 4. 2017 California Building Code
  - 5. Local Municipal Codes.

#### 1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.



## ANSI/TIA:

- TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
- d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
- e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
- f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
- g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
- h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
- i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
- j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
- k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
- ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
- m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
- n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
- ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
- p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
- q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
- r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
- s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises External Grounding Addendum
- u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.



- x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
- z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
- aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 Industrial Pathways and Spaces
- bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

## 2. ISO/IEC

- a. ISO 11801 (November 2010) Generic Cabling for Customer Premises
- b. ISO/IEC TR 14763-2-1:2012 Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation Identifiers within administration system.
- 3. National Electric Codes
  - a. National Electrical Safety Code (2017)
  - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
  - c. ANSI/IEEE C2-207, National Electrical Safety Code®
  - d. National Electrical Code (NEC) (NFPA 70)
- 4. OSHA Standards and Regulations all applicable
- 5. Local Codes and Standards all applicable
- 6. BICSI
  - a. Telecommunications Distribution Methods Manual, 13th Edition
  - b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
  - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th
  - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
  - e. Network Systems and Commissioning (NSC) reference, 1st Edition
  - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
  - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
  - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
  - i. AV Design Reference Manual, 1st Edition
  - j. Network Design Reference Manual, 7th Edition
  - k. Outside Plant Design Reference Manual, 5th Edition
  - I. Wireless Design Reference Manual, 3rd Edition
  - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- 7. Anywhere cabling Standards conflict with electrical or safety Codes, Subcontractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- 8. Knowledge and execution of applicable codes is the sole responsibility of the Subcontractor.
- 9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.



# 1.05 AMINISTRATIVE REQUIREMENTS

#### A. Coordination:

Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the sub-contractor's neglect, shall be made by the sub-contractor at their own expense.

## B. Scheduling:

 Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

## 1.06 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
  - 1. Submit all product data in accordance with general requirements of the construction documents.
  - 2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
  - 3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
  - 4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

# 1.07 INFORMATIONAL SUBMITTALS

## A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

# B. Certificates:

- 1. Submit management and installation team reference documentation verifying:
  - a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.



b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents.

# C. Qualification Statements:

 The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

#### 1.08 CLOSEOUT SUBMITTALS

## A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
- 2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:
- 3. Communication sub-contractor to print, frame and mount approved as-built drawings in MPOE. Coordinate location with A/E.

## 1.09 QUALITY ASSURANCE

### A. Qualifications – Manufacturer

 Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

#### B. Qualifications – Installer:

 At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

#### PART 2 - PRODUCTS

#### 2.01 IDENTIFICATION LABELS

- A. Basis-of-Design Product: Subject to compliance with requirements:
  - 1. Leviton System
  - 2. Brady Label System
  - 3. Brother Label System
  - 4. Or Equal

# B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

## C. Description:

- 1. In new installations (Greenfield), Sub-contractor shall develop and submit for approval a labeling strategy based on the TIA 606-B Circuit Designation and Labeling Standard.
- 2. All labels shall be machine-manufactured by a labeling machine. Handwritten labels will not be accepted for final labeling.
- 3. The intention of the labeling scheme is to be TIA/EIA 606-B compliant.



- 4. It is the responsibility of the sub-contractor to acquire, understand, and utilize the owner's labeling scheme for all component of the voice data communications system.
- 5. It is the responsibility of the sub-contractor to provide labels sized to show the Owner's labeling scheme in readable font size while still matching the specified hardware identification dimensions.
- 6. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- D. Indoor Copper and Fiber optic cables and grounding conductors:
  - 1. The cable sheaths shall be labeled with laser-printed polyester self-laminating wrap around labels sized to fit the Owner's labeling scheme in readable font size.
- E. Horizontal cable outlet housings and faceplates:
  - Cable termination connectors at each position on the outlet housing shall be labeled with laser-printed polyester labels inserted into the outlet housing labeling window.
- F. Copper patch panels:
  - 1. The patch panels shall be labeled on the front and rear top left corner with a laser-printed polyester self-laminating label sequentially identifying the patch panel.
- G. Copper patch termination blocks:
  - The termination blocks shall be labeled on the front rows with the termination block designation strip colored per the BICSI requirements identifying the copper cable pairs.
- H. Fiber optic termination panels and housings:
  - 1. The panels and housings shall be labeled on the outside front and rear top left corner with a laser-printed polyester self-laminating label sequentially identifying the panel.
  - 2. Cable termination identifier and fiber positions inside the termination panels shall be made using the manufacturer's provided label card behind the plastic panel.
- I. Equipment racks:
  - 1. Bakelite plastic label engraved with rack label scheme attached to front and rear facing top angle bracket.
  - 2. Label shall be adhesive backed for secure placement. Optional mounting with self tapping screws will be at the discretion of owner.
- J. Equipment cabinets:
  - 1. Bakelite plastic label engraved with cabinet label scheme attached to top front and rear facing frame of cabinet.
  - 2. Label shall be adhesive backed for secure placement. Optional mounting with self tapping screws will be at the discretion of owner.
- K. Indoor Conduits and pullboxes:
  - Each section of conduit shall be labeled on the outside facing and unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the conduit and its origin and termination end (to and from).



2. Each pullbox shall be labeled on the outside door panel facing and unobstructed view with a laser-printed polyester self-laminating label sequentially identifying the pullbox and building location.

#### PART 3 - EXECUTIONEXAMINATION

A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section.

#### 3.02 INSTALLATION

#### A. Process:

- The Owner-provided labeling scheme is intended to comply with TIA/EIA 606-B standard for labeling and administration of a cable plant. It is the responsibility of the sub-contractor to acquire, understand, and utilize the owner's labeling scheme for all component of the voice data communications system including, but not limited to:
- 2. Indoor Horizontal copper and fiber optic cables (Identify at both ends within 6-inches of termination).
- 3. Indoor copper and fiber optic backbone cables (Identify at both ends within 12-inches of the point that the cable enters termination panels/blocks, within 12- of the point that the cable enters or exits pullboxes, wall and floor sleeves.
- 4. Workstation outlets, faceplates and individual outlet connectors.
- 5. Termination panels.
- 6. Termination blocks.
- 7. Racks, cabinets, and equipment enclosures. (front and rear).
- 8. Indoor conduit pathways and pullboxes.
- 9. Grounding conductors and ground bars.
- 10. Label each component with a specified label at an unobstructed view location and where it is accessible for administration.

## 3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

## 3.04 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.

#### **END OF SECTION**



### **SECTION 27 11 19**

## TERMINATION BLOCKS AND PATCH PANELS FOR COMMUNICATIONS SYSTEMS

#### PART 1 - GENERAL

#### 1.01 SUMMARY

#### A. Section Includes:

- 1. Provides specifications for wall and rack/cabinet-mounted blocks, termination panels and patch panel components utilized to terminate various telecommunications infrastructure cabling and connectivity.
- 2. Optical Fiber Termination panels.
- 3. Copper horizontal cabling Patch Panels.

#### 1.02 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.

## 1.03 REFERENCES

- A. Abbreviations and Acronyms:
  - 1. ANSI: American National Standards Institute
  - 2. A/E: Architect / Engineer (designer)
  - 3. BICSI: Building Industry Consulting Service International
  - 4. EIA: Electronics Industry Alliance5. IDF: Intermediate Distribution Facility
  - 6. MDF Main Distribution Facility
  - RCDD: Registered Communications Distribution Designer
     TCIM: Telecommunication Cabling Installation Manual
     TDMM: Telecommunications Distribution Methods Manual
  - 10. TIA: Telecommunications Industry Association
- B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
  - 1. National Electric Code (2017)
  - 2. National Fire Protection Association (NFPA)
  - 3. 2016 California Electrical Code
  - 4. 2016 California Building Code
  - 5. Local Municipal Codes

#### 1.04 APPLICABLE REGULATORY REFERENCES

- A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
  - 1. ANSI/TIA:



- TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
- d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
- e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
- f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
- g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
- h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
- i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
- j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
- k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
- ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
- m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
- n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
- ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
- p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
- q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
- r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
- s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises External Grounding Addendum
- u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.



- x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
- z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
- aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 Industrial Pathways and Spaces
- bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

### 2. ISO/IEC

- a. ISO 11801 (November 2010) Generic Cabling for Customer Premises
- b. ISO/IEC TR 14763-2-1:2012 Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation Identifiers within administration system.
- 3. National Electric Codes
  - a. National Electrical Code (2017)
  - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
  - c. ANSI/IEEE C2-207, National Electrical Safety Code®
  - d. National Electrical Code (NEC) (NFPA 70)
- 4. OSHA Standards and Regulations all applicable
- 5. Local Codes and Standards all applicable
- 6. BICSI
  - a. Telecommunications Distribution Methods Manual, 13th Edition
  - BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
  - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
  - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
  - e. Network Systems and Commissioning (NSC) reference, 1st Edition
  - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
  - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
  - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
  - i. AV Design Reference Manual, 1st Edition
  - j. Network Design Reference Manual, 7th Edition
  - k. Outside Plant Design Reference Manual, 5th Edition
  - I. Wireless Design Reference Manual, 3rd Edition
  - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- 7. Anywhere cabling Standards conflict with electrical or safety Codes, Subcontractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- 8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
- 9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.



#### 1.05 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

1. Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the subcontractor's neglect, shall be made by the sub-contractor at their own expense.

### B. Scheduling:

 Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

### 1.06 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
  - 1. Submit all product data in accordance with general requirements of the construction documents.
  - 2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
  - 3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
  - 4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

## 1.07 INFORMATIONAL SUBMITTALS

#### A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

## B. Certificates:

- 1. Submit management and installation team reference documentation verifying:
  - a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.



b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

## C. Qualification Statements:

 The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

#### 1.08 CLOSEOUT SUBMITTALS

## A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
- 2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

#### 1.09 QUALITY ASSURANCE

#### A. Qualifications – Manufacturer

1. Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

## B. Qualifications – Installer:

At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

#### PART 2 - PRODUCTS

#### 2.01 OPTICAL FIBER TERMINATION PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements:
  - 1. AFL / Dura-Line

#### B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular infrastructure requirements.

#### C. Description:

- 1. 19-inch Rack mountable fiber optic termination shelf with maximum 144-positions with integrated splicing for termination inside Telecom rooms.
- 2. Minimum 2U rack units' height.
- Optical fiber termination panel housings shall be provided for cross-connecting or inter-connecting purposes between OSP, Indoor riser backbone, and/or distribution cables and the active network electronic switches, as noted in drawings.



- 4. Single mode termination: Fusion splice both ends of each single mode fiber optic strand onto factory connectorized single mode pigtails mounted in connector housings assembled by the manufacturer of the single mode fiber optic cable.
  - a. Single-Mode splice-on Connector is acceptable.
- 5. All optical fiber housings shall be complete factory-provided assemblies that contain all components including LC duplex connector adapter panels and internal/external bend radius, strain relief and cable clamp components that are provided in a housing which includes an accessible rear access hatch.
- 6. All optical fiber patch panel trays and associated bulkhead inserts shall have factory numerical labeling included in the design and presentation to the user side of the panel.
- 7. The optical fiber patch panel bulkheads that house the terminating modules for the fiber backbone cabling and any horizontal optical fiber cabling shall accept TIA 568-C standard-compliant LC-connectors compatible with the optical fiber strands being terminated.

# D. Accessory Products:

1. Provide any accessory products related to the optical fiber termination panels to provide a complete and functional infrastructure system.

## 2.02 COPPER HORIZONTAL CABLING PATCH PANELS

#### A. Manufacturer List:

- 1. Leviton
  - a. Angled Category 6A 48 Port
    - 1) Part Number 6A587-U48

# B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each component selected shall address the particular requirements for each situation.

## C. Description:

- 1. All angled patch panels are to be rack/cabinet mountable within industry standard TIA/EIA 19" mounting rails unless otherwise noted.
- 2. All angled patch panels are to provide adequate space for individual port labeling on the front and cable/connector labeling on the back.
- 3. All installed station cable patch panels shall be Category 6A twenty-four (24) or forty-eight (48) port flat patch panels
- 4. All multi-pair backbone OSP cables terminated in a TR will be terminated on a BEC protection block. Reference Division 270526 specification.
- 5. The performance criteria for the patch panels must meet or exceed the performance parameters for frequency, attenuation, near end cross-talk (NEXT), attenuation to cross-talk ratio (ACR), power sum NEXT (PS-NEXT), power sum ACR (PS-ACR), equal level far end cross-talk (ELFEXT), power sum far end cross-talk (PS-FEXT), and return loss (RL) as set forth in TIA/EIA 568-C category standards.

#### D. Accessory Products:

1. Provide any accessory products related to the patch panels to provide a complete and functional infrastructure system.



- 2. Port RJ-45 jack block out device to safely secure access to unused ports and deter vandalism to jacks.
- 3. Provide complete with all required mounting hardware and fittings and cables needed.

#### PART 3 - EXECUTIONEXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
  - 1. Electrical requirements (conduit installation and capacity)
  - 2. The telecommunications rooms are the size shown on the project drawings.
  - 3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
  - 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

#### 3.02 INSTALLATION

#### A. Process:

- Install all optical fiber and category copper termination panels/panels under the guidelines of the manufacturer's recommended instructions and per all TIA/EIA 568-C standards and manufacturer-approved industry practices as shown in the drawings.
- 2. The installation and performance parameters of all installed cable termination panels shall be verified by the sub-contractor through TIA/EIA 568-C testing procedures.
- 3. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the Owner.

#### B. Installation description:

- Sub-contractor shall use existing cabling management pathways and take care to place cable like with like, maintaining original segregation strategies for separating fiber and copper cables as well as any separation necessary between different types of copper cables.
- Cables shall be dressed neatly within patch management pathways with care taken to maintain minimum bend radius of not less than 1 times the cord outer diameter for copper and not less than a 1" bend radius for fiber jumpers as per ANSI/TIA 568-C.0
- The installation and performance parameters of all installed cable termination panels shall be verified by the sub-contractor through TIA/EIA 568-C testing procedures.
- 4. Label all cable termination panels to identify each port and each specific panel in accordance with the TIA/EIA 606 labeling scheme approved by the Owner.

#### 3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components due to



manufacturer defects or sub-contractor poor performance. Scheduling for reinstallation work shall be coordinated, in writing, with the owner prior to beginning any re-installation work.

# 3.04 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

**END OF SECTION** 



### **SECTION 27 13 23**

## OPTICAL FIBER BACKBONE CABLING

#### PART 1 - GENERAL

#### 1.01 SUMMARY

#### A. Section Includes:

- 1. Provides specifications for optical fiber backbone cabling to distribute optical network signals between telecommunications distribution spaces
- 2. Backbone Air-Blown Single-mode Optical Fiber Cable

### 1.02 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.

#### 1.03 REFERENCES

A. Abbreviations and Acronyms:

1. ANSI: American National Standards Institute

2. A/E: Architect / Engineer (designer)

3. BICSI: Building Industry Consulting Service International

4. EIA: Electronics Industry Alliance5. IDF: Intermediate Distribution Facility

6. MDF Main Distribution Facility

7. RCDD: Registered Communications Distribution Designer

SMF: Single-Mode Fiber
 MM: Multi-Mode Fiber

10. TCIM: Telecommunication Cabling Installation Manual11. TDMM: Telecommunications Distribution Methods Manual

12. TIA: Telecommunications Industry Association

- B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
  - 1. National Electric Code (2017)
  - 2. National Fire Protection Association (NFPA)
  - 3. 2016 California Electrical Code
  - 4. 2016 California Building Code
  - 5. Local Municipal Codes

#### 1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.



#### 1. ANSI/TIA:

- TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
- d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
- e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
- f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
- g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
- h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
- i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
- j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
- k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
- ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
- m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
- n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
- ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
- p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
- q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
- r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
- s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises External Grounding Addendum
- u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.



- x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
- z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
- aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 Industrial Pathways and Spaces
- bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

### 2. ISO/IEC

- a. ISO 11801 (November 2010)- Generic Cabling for Customer Premises
- b. ISO/IEC TR 14763-2-1:2012 Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation Identifiers within administration system.
- 3. National Electric Codes
  - a. National Electrical Code (2017)
  - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
  - c. ANSI/IEEE C2-207, National Electrical Safety Code®
  - d. National Electrical Code (NEC) (NFPA 70)
- 4. OSHA Standards and Regulations all applicable
- 5. Local Codes and Standards all applicable
- 6. BICSI
  - a. Telecommunications Distribution Methods Manual, 13th Edition
  - b. BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
  - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
  - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
  - e. Network Systems and Commissioning (NSC) reference, 1st Edition
  - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
  - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
  - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
  - i. AV Design Reference Manual, 1st Edition
  - j. Network Design Reference Manual, 7th Edition
  - k. Outside Plant Design Reference Manual, 5th Edition
  - I. Wireless Design Reference Manual, 3rd Edition
  - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- 7. Anywhere cabling Standards conflict with electrical or safety Codes, Subcontractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- 8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
- 9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.



#### 1.05 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the subcontractor's neglect, shall be made by the sub-contractor at their own expense.

### B. Scheduling:

 Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

### 1.06 ACTION SUBMITTALS

## A. Product Data: For each product indicated.

- Submit all product data in accordance with general requirements of the construction documents.
- 2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
- 4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

## 1.07 INFORMATIONAL SUBMITTALS

#### A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

## B. Certificates:

- 1. Submit management and installation team reference documentation verifying:
  - a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
  - b. The field supervisor is a BICSI trained technician that is qualified to perform



#### and oversee the work described in the contract documents

### C. Qualification Statements:

 The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

## 1.08 CLOSEOUT SUBMITTALS

## A. As-Built Drawings:

- 1. Submit all as-built documentation in accordance with the general requirements of the construction documents.
- 2. Cabling as-built drawings must contain detailed location and identification information coordinated with the as-built cable schedules.
- 3. All cabling must meet or exceed applicable TIA/EIA testing requirements and any additional parameters outlined in the Commissioning of Communications specification section 27 08 00.
- 4. Test results must be submitted for owner review and approval adhering to the General Contractor schedule milestones related to the projects active systems integration.

## 1.09 QUALITY ASSURANCE

#### A. Qualifications – Manufacturer

 Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

#### B. Qualifications – Installer:

 At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

## PART 2 - PRODUCTS

#### 2.01 BACKBONE SINGLE-MODE OPTICAL CABLING

- A. Basis-of-Design Product: Subject to compliance with requirements:
  - 1. AFL/Dura-Line Air-Blown Fiber (MDF to IDF)
  - 2. Berk-Tek Conventional Single Mode Fiber (Phase 2 Remote Cameras and Emergency Phones)

## B. Product Options:

 The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E. Cable construction shall be a hybrid multi-mode and singlemode fiber stands combined in a single protection jacket as indicated on the project drawings.

## C. Description:

1. All backbone single-mode optical fiber cable shall be capable of 10 Gb/s Ethernet



- signal transmission to 10,000 meters in the 1310nm operating window. Maximum attenuation for a single-mode cable shall be no greater than 0.4dB per kilometer using 1310nm and 0.3dB per kilometer using 1550nm wavelengths respectively.
- 2. Each optical fiber strand shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification and all EIA/TIA 568-C.3 and 568-C.3-1 performance parameters.
- 3. All optical fibers inside each individual cable shall be provided in counts indicated in the drawings and usable to the fullest capacity specified by the manufacturer and meet required specifications at all times.
- 4. Air-Blown backbone single-mode optical fiber cables shall be:
  - a. Individual jacketed, tight buffered fiber type.
  - b. Cable construction shall be a single-mode in a single protective outer sheath.
  - c. The individual fibers are grouped in jacketed subunits color coded per TIA-598.
- 5. The optical fiber cables shall be rated per the installation environment as required by the local Authority Having Jurisdiction and/or National Fire Codes. Select an appropriate cable construction, including external jacket properties, when installing optical fiber cables in aerial, outdoor, underground and corrosive environments.
- 6. All SMF shall meet or exceed TIA compliant network cable-testing device certification by an independent laboratory, such as ETL, for verification of high speed, TIA/EIA T568C-compliant performance.
- D. Cable sizes defined in Contract Documents.
  - 1. 6-strand Single-mode AFL/Dura-Line eABF (IDF Locations)
  - 2. 6-strand Single-mode Conventional Indoor/Outdoor (Pole Cameras and Emergency Phone Locations)

# E. Accessory Products:

1. Provide any accessory products related to the optical fiber backbone cabling required to provide a complete and functional infrastructure system.

#### 2.2 EXTERIOR TUBE-CELL SYSTEMS

# A. Description:

- 1. All tube cable sheath openings that are created for connecting tube cable cells in underground manholes or pull boxes shall be encased in an outside plant splice case designed for copper cables.
- 2. The water-proof splice enclosure must be approved by the manufacturer fo connecting tube cables.
- 3. All tube cables shall have the proper end plate adapter to provide the necessary watertight seal in the splice enclosure.
- 4. Tube cable sizes shall be 4- or 2-cell depending on the design on the drawings. The standard tube in conduit shall be eABF DuraLine.
- 5. All unterminated or unoccupied tubes shall be plugged / capped on both ends with manufacturer specific tube sealing components.
- 6. All MDF tube cable will transition to 5mm OD clear tubing for routing to the FTU.



### B. Products:

- AFL/Dura-Line
  - a. OSP 4-Cell eABF Futurepath Enterprise
    - Part Number 10004655

#### PART 3 - EXECUTIONEXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
  - 1. Electrical requirements (conduit installation and capacity)
  - 2. The telecommunications rooms are the size shown on the project drawings.
  - 3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
  - 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

#### 3.02 INSTALLATION

#### A. Process:

- Install all backbone cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA 568C and BICSI, and in quantities indicated in the drawings.
- 2. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. The cable manufacturer's specifications for each particular cable type shall be followed exactly.
- 3. Backbone cable shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances shall be replaced at no additional cost to the owner.
- 4. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded as noted in BICSI guidelines.
- 5. Install backbone cables with attention paid to aesthetic means and methods when routing cabling within IT spaces. No backbone cable shall be left unsupported for more than three (3) feet vertically or horizontally at any time.
- 6. Fiber optic cables shall be placed in neat bundles separated from other communications cabling. Fiber optic cables shall be neatly placed and lashed with Velcro ties to the horizontal and vertical cable management and runways at minimum 4-foot intervals, not to exceed every 4th rung, plus all locations where the cables change direction.
- 7. Provide radius drop out fittings at all locations where fiber optic cables transition from vertical to horizontal cable management systems.
- 8. All backbone cable shall be securely fastened to the termination shelf with a manufacturers strain relief bracket and termination panel cable clamp in a way that does not damage the optical fiber strands or impede the performance of the media. This secure fastening method shall also serve to insure a secure termination environment.
- 9. A minimum of three feet (3'-0") of each optical fiber strand shall be left protected within the termination shelf for any future re-termination of a particular optical fiber strand.



10. All backbone cables shall be clearly labeled on both ends and in an accessible location no more than one (1) foot from each cable end.

# 3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

## 3.04 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

## **END OF SECTION**



#### **SECTION 27 15 43**

## **FACEPLATES AND CONNECTORS**

#### PART 1 - GENERAL

#### 1.01 SUMMARY

#### A. Section Includes:

- 1. Provides specifications for horizontal workstation cable termination components and outlet housing component. Includes wall-mount, floor-mount, and ceiling-mount components to support the various workstation outlets throughout the cabling plant.
- 2. Copper Category 6A Connectors
- 3. Single-Mode Optical Fiber Pigtail Connector Assemblies/Splice-On Connectors
- 4. Outlet Housing Components (faceplates etc.)

#### 1.02 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.

#### 1.03 REFERENCES

A. Abbreviations and Acronyms:

1. ANSI: American National Standards Institute

2. A/E: Architect / Engineer (designer)

3. BICSI: Building Industry Consulting Service International

EIA: Electronics Industry Alliance
 IDF: Intermediate Distribution Facility
 LOMMF: Laser Optimized Multi-Mode Fiber

MDF Main Distribution Facility
 NEXT: Near End Cross Talk

9. PSELFEXT: Power Sum Equal Level Far End Cross Talk

10. PSNEXT: Power Sum Near End Cross Talk

11. RCDD: Registered Communications Distribution Designer

12. SMF: Single-Mode Fiber

TCIM: Telecommunication Cabling Installation Manual
 TDMM: Telecommunications Distribution Methods Manual

15. TIA: Telecommunications Industry Association

- B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
  - 1. National Electric Safety Code (2017)
  - 2. National Fire Protection Association (NFPA)
  - 3. 2017 California Electrical Code
  - 4. 2017 California Building Code
  - 5. Local Municipal Codes



#### 1.04 APPLICABLE REGULATORY REFERENCES

- A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.
  - 1. ANSI/TIA:
    - TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
    - b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
    - c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
    - d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
    - e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
    - f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
    - g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
    - h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
    - i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
    - j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
    - k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
    - ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
    - m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
    - n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
    - ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
    - p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
    - q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
    - r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
    - s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
    - t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises External Grounding Addendum



- u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
- w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
- x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
- z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
- aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 Industrial Pathways and Spaces
- bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

## 2. ISO/IEC

- a. ISO 11801 (November 2010) Generic Cabling for Customer Premises
- b. ISO/IEC TR 14763-2-1:2012 Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation Identifiers within administration system.
- National Electric Codes
  - a. National Electrical Code (2017)
  - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
  - c. ANSI/IEEE C2-207, National Electrical Safety Code®
  - d. National Electrical Code (NEC) (NFPA 70)
- 4. OSHA Standards and Regulations all applicable
- 5. Local Codes and Standards all applicable
- 6. BICSI
  - a. Telecommunications Distribution Methods Manual, 13th Edition
  - BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
  - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
  - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
  - e. Network Systems and Commissioning (NSC) reference, 1st Edition
  - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
  - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
  - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
  - i. AV Design Reference Manual, 1st Edition
  - j. Network Design Reference Manual, 7th Edition
  - k. Outside Plant Design Reference Manual, 5th Edition
  - I. Wireless Design Reference Manual, 3rd Edition
  - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- 7. Anywhere cabling Standards conflict with electrical or safety Codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.



- 8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
- 9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.

#### 1.05 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the subcontractor's neglect, shall be made by the sub-contractor at their own expense.

## B. Scheduling:

 Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

#### 1.06 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
  - 1. Submit all product data in accordance with general requirements of the construction documents.
  - 2. Submit product cut sheets and a detailed list of components a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
  - 3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
  - 4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

#### 1.07 INFORMATIONAL SUBMITTALS

## A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of two (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

### B. Certificates:

1. Submit management and installation team reference documentation verifying:



- a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
- b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

### C. Qualification Statements:

 The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

## 1.08 CLOSEOUT SUBMITTALS

## A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
- 2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

## 1.09 QUALITY ASSURANCE

#### A. Qualifications – Manufacturer

 Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

#### B. Qualifications – Installer:

 At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

### PART 2 - PRODUCTS

## 2.01 COPPER UTP CONNECTORS

- A. Basis-of-Design Product: Subject to compliance with requirements:
  - 1. Leviton: Category UTP Category 6A Connectors.

# B. Product Options:

1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.

# C. Description:

- All UTP connectors shall be rated to perform at or above current TIA/EIA performance parameters of the UTP cabling it is terminating within the communications system.
- 2. All UTP connectors shall have an eight (8) position, eight (8)-conductor module that accepts RJ-45 plugs.
- 3. When utilized as part of a channel or permanent link, all high performance



modular outlet connectors shall not decrease the horizontal cable elevated performance transmission requirements before and after installation as specified in ANSI/TIA/EIA 568-C Commercial Building Telecommunications Cabling Standard (horizontal cable section) in all noted performance parameters.

# D. Accessory Products:

- 1. Provide any accessory products related to the UTP connectors required to provide a complete and functional infrastructure system.
- 2. Port RJ-45 jack block out device to safely secure access to unused ports and deter vandalism to jacks.
- 3. Provide complete with all required mounting hardware and fittings and cables needed

## 2.02 SINGLE MODE OPTICAL FIBER PIGTAIL CONNECTORS ASSEMBLIES

### A. Manufacturer List:

1. AFL

## B. Product Options:

1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.

## C. Description:

- 1. Singlemode Optical fiber pigtail connector assemblies housed in manufacturers connector panels.
- 2. AFL FUSEConnect Splice On Connector is acceptable.
- 3. Duplex LC style connectors.
- 4. Maximum insertion loss across mated pair shall be less than 0.3 dB, tested per FOTP-171 Method A. Typical Insertion loss should be maximum of 0.15 dB. Minimum return loss shall be less than 60.5 dB, tested per FOTP-171. Typical return loss should be 60 dB.
- 5. Pigtails shall have minimum 2 meters of attached cordage.
- 6. Pigtails shall be assembled and tested by the connector manufacturer.

## D. Accessory Products:

 Provide any accessory products and tool kits related to the termination of the optical fiber connectors to provide a complete and functional infrastructure system.

## 2.03 OUTLET HOUSING COMPONENTS

#### A. Manufacturer List:

- 1. Leviton
  - a. Cat6A Connectors Atlas-X1
    - 1) Part Number 6AUJK-RL6 (L=Blue)
  - b. Wall Plates 4-Port Angled Single Gang
    - 1) Part Number 42081-4Xs (x-Color)

## B. Product Options:

1. The manufacturers noted above shall be the only manufacturers acceptable to the Owner and A/E.



## C. Description:

- 1. All outlet housings at the various technology outlet locations shall provide the designated number modular insert ports as indicated in the drawings.
- 2. All flush-mounted faceplates shall be provided per the port configurations shown on the telecom drawings.
- 3. Faceplates for wall-mounted phones shall be one (1) port single gang faceplates that have wall-mount lugs allowing vertical phone mounting.
- 4. Faceplates for flush floor mounted outlets shall be coordinated with the floor box or poke thru device that will be selected and installed outside the scope of this section.
- 5. System furniture faceplates shall be capable of fitting in the furniture system selected by the Owner. Furniture faceplates shall be provided per the port configurations shown on the telecom drawings. Furniture faceplate extenders shall be used (if required) to maintain proper bend radii within the furniture raceway/pathway.
- 6. Surface mounted boxes shall be capable of the quantity of outlet jack requirements at each outlet locations indicted in the drawings.
- 7. All outlet-housings shall provide a clear TIA/EIA 606-A labeling location for both the individual outlet port and the entire outlet housing location, unless otherwise indicated in the project drawings.

### D. Accessory Products:

1. Provide any accessory products related to the workstation outlet housing components required to provide a complete and functional infrastructure system.

#### PART 3 - EXECUTIONEXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
  - 1. Electrical requirements (conduit installation and capacity)
  - 2. The telecommunications rooms are the size shown on the project drawings.
  - 3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
  - 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

# 3.02 INSTALLATION

# A. Process:

- Install all connectors and couplers under the guidelines of the manufacturers' recommended instructions and per all TIA/EIA 568C standards, BICSI guidelines, and manufacturer approved industry practices.
- 2. The installation and performance parameters of all installed couplers and connectors shall be verified by the trade sub-contractor through TIA/EIA 568C testing procedures.
- 3. Color of all outlet housing components shall be coordinated with the Owner before purchase and installation.
- 4. All technology outlets located on walls shall be flush mounted, level and plumb.



- 5. All technology outlets shall be mounted at right angles and parallel to the floor, unless installation requirements or design dictate otherwise.
- 6. Install blank inserts in outlet housing spaces that are not being filled with cable termination modules. Blank inserts shall match the workstation housing color, unless otherwise indicated in the drawings.
- 7. All outlets located in systems furniture may be served from a wall adjacent to the furniture cluster or a floor box. If the cable is exposed prior to entering furniture raceway, install spiral wrap tubing to protect the cable per the manufacturer's recommendations.
- 8. All outlet housings as well as each individual utilized port must be labeled in accordance with the Owner-approved labeling scheme.

## 3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work

#### 3.04 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner

**END OF SECTION** 



### **SECTION 27 16 19**

## **COMMUNICATION PATCH CORDS**

### PART 1 - GENERAL

### 1.01 SUMMARY

#### A. Section Includes:

- 1. Provides specifications for Category 6 and optical fiber horizontal cable patching to distribute network signals.
- 2. Copper Category 6A Patch Cords.
- 3. Optical Fiber Patch Cords.

## 1.02 RELATED DOCUMENTS

- A. All divisions of the specification and general provisions of the Construction Documents.
- B. Architectural, mechanical, electrical, and all technology drawings.

#### 1.03 REFERENCES

A. Abbreviations and Acronyms:

1. ANSI: American National Standards Institute

2. A/E: Architect / Engineer (designer)

3. BICSI: Building Industry Consulting Service International

EIA: Electronics Industry Alliance
 IDF: Intermediate Distribution Facility
 LOMMF: Laser Optimized Multi-Mode Fiber

7. MDF Main Distribution Facility8. NEXT: Near End Cross Talk

9. RCDD: Registered Communications Distribution Designer

10. SMF: Single-Mode Fiber

11. TCIM: Telecommunication Cabling Installation Manual12. TDMM: Telecommunications Distribution Methods Manual

13. TIA: Telecommunications Industry Association

- B. Codes and Regulations: (Note: Reference Division One for specific code versions governing the work in addition to the information noted below.)
  - 1. National Electric Safety Code (NESC) 2017
  - 2. National Fire Protection Association (NFPA)
  - 3. 2016 California Electrical Code
  - 4. 2016 California Building Code
  - 5. Local Municipal Codes

### 1.04 APPLICABLE REGULATORY REFERENCES

A. Sub-contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have



been updated, Sub-contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

## 1. ANSI/TIA:

- a. TIA-526-7 (OFSTP-7) (July 2015) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- b. TIA-526-14-B (April 2015) (OFSTP-14) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
- c. ANSI/TIA/EIA-598-C (July 2014) Optical Fiber Cable Color Coding
- d. ANSI/TIA-568-C.0 (December 2015) Generic Telecommunications Cabling for Customer Premises
- e. TIA-568-C.0-1 (September 2012) Generic Telecommunications Cabling for Customer Premises-Addendum 1, Updated Reference for Balanced Twisted-Pair Cabling
- f. ANSI/TIA-568-C.1 (February 2012) Commercial Building Telecommunications Cabling Standards
- g. TIA-568-C.1-2 (November 2014) Commercial Building Telecommunications Cabling Standard, Addendum 2 General Updates
- h. ANSI/TIA-568-C.2 (June 2016) Balanced Twisted Pair Communications Cabling and Components Standards
- i. ANSI/TIA-568-C.3 (June 2011) Optical Fiber Cabling Components Standard
- j. ANSI/TIA-568-C.3-1 (December 2011) Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors
- k. ANSI/TIA-1183 (August 2012) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
- ANSI/TIA-1183-1 (January 2016) Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Addendum 1 – Extending Frequency Capabilities to 2 GHz.
- m. ANSI/TIA-568-C.4 (July 2011) Broadband Coaxial Cabling Components Standard
- n. ANSI/TIA-942-A (August 2012) Telecommunications Infrastructure Standard for Data Centers
- o. ANSI/TIA-942-A-1 (March 2013) Telecommunications Infrastructure Standard for Data Centers, Addendum 1 Cabling Guidelines for Data Center Fabrics
- p. TIA-569-D (April 2015) Telecommunications Pathways and Spaces
- q. TIA-569-D-1 (October 2016) Telecommunications Pathways and Spaces Addendum 1- Revised Temperature and Humidity Requirements for Telecommunications Spaces
- r. ANSI/TIA-606-B (December 2015) Administration Standard for Telecommunications Infrastructure
- s. TIA-607-B (November 2015) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- t. TIA-607-B-1 (January 2017) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises External Grounding Addendum
- u. TIA-758-B (April 2012) Customer-Owned Outside Plant Telecommunication Infrastructure Standard
- v. TIA-1152 (November 2016) Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling



- w. ANSI/TIA-862-B (February 2016) Structured Cabling Infrastructure Standard for Intelligent Building Systems.
- x. TIA-570-C (August 2012) Residential Telecommunications Infrastructure Standard
- y. TIA-1005-A (June 2012) Industrial Telecommunications Infrastructure Standard for Manufacturing, Process & Refining
- z. ANSI/TIA-1005 (January 2015) Telecommunications Infrastructure Standard for Industrial Premises
- aa. TIA-1005-1 (May 2012) Telecommunications Infrastructure Standard for Industrial Premises; Addendum 1 Industrial Pathways and Spaces
- bb. TIA-1179 (July 2010) Healthcare Facility Telecommunications Infrastructure Standard.

## 2. ISO/IEC

- a. ISO 11801 (November 2010) Generic Cabling for Customer Premises
- b. ISO/IEC TR 14763-2-1:2012 Information technology -- Implementation and operation of customer premises cabling -- Part 2-1: Planning and installation Identifiers within administration system.
- National Electric Codes
  - a. National Electrical Safety Code (2017)
  - b. ANSI/NFPA 70-2017, National Electrical Code© (NEC©)
  - c. ANSI/IEEE C2-207, National Electrical Safety Code®
  - d. National Electrical Code (NEC) (NFPA 70)
- 4. OSHA Standards and Regulations all applicable
- 5. Local Codes and Standards all applicable
- 6. BICSI
  - a. Telecommunications Distribution Methods Manual, 13th Edition
  - BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
  - c. Information Technology Systems Installation Methods Manual (ITSIMM), 6th Edition
  - d. ANSI/BICSI 002-2014, Data Center Design and Implementation Best Practices
  - e. Network Systems and Commissioning (NSC) reference, 1st Edition
  - f. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
  - g. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
  - h. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 Educational Institutions
  - i. AV Design Reference Manual, 1st Edition
  - j. Network Design Reference Manual, 7th Edition
  - k. Outside Plant Design Reference Manual, 5th Edition
  - I. Wireless Design Reference Manual, 3rd Edition
  - m. Electronic Safety and Security Design Reference Manual, 3rd Edition.
- 7. Anywhere cabling Standards conflict with electrical or safety Codes, Subcontractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either.
- 8. Knowledge and execution of applicable codes is the sole responsibility of the Sub-contractor.
- 9. Any code violations committed at the time of installation shall be remedied at the Sub-contractor's expense.



#### 1.05 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

Install and coordinate the telecommunications cabling work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interference in a manner accepted by the architect. Any repairs or changes made necessary in the contract work, caused by the subcontractor's neglect, shall be made by the sub-contractor at their own expense.

### B. Scheduling:

 Contract Documents and the overall construction schedule must be carefully reviewed to determine all required interfacing and timing of the work. All such documents shall be available through the General Contractor or Construction Manager.

## 1.06 ACTION SUBMITTALS

## A. Product Data: For each product indicated.

- Submit all product data in accordance with general requirements of the construction documents.
- 2. Submit product cut sheets and a detailed list of components a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Alternate and "Or Equal" designated products must be submitted for review and judgment to the A/E prior to installation. The sub-contractor-proposed alternate products or components must be verified by two (2) independent sources within the past 6 months. This request shall include the two (2) independent sources, the original Product's specification sheet, the proposed substitute product cut sheet, and a written request to review the substitute product.
- 4. Any request of an alternate or substitution must be submitted to the A/E for action no later than fourteen (14) calendar days after release of the original telecommunications bid documents.

#### B. Samples:

# 1.07 INFORMATIONAL SUBMITTALS

#### A. Coordination Drawings:

- 1. Submit all shop drawings in accordance with the general requirements of the construction documents.
- 2. Submit shop drawings a minimum of six (2) weeks prior to commencement of Division-27 work for A/E review and action.
- 3. Shop drawings shall include evidence of grounding and bonding components are coordinated with field conditions and the work of other trades.
- 4. This submittal may have a written component and a visual, drawn component for review and action by the A/E prior to installation.

## B. Certificates:

- Submit management and installation team reference documentation verifying:
  - a. The project manager is a RCDD in good standing with BICSI and is qualified to manage the scope of work described in the contract documents



- and has five (5) years of experience managing similar projects in size and scope. The documentation shall include the RCDD registration number.
- b. The field supervisor is a BICSI trained technician that is qualified to perform and oversee the work described in the contract documents

# C. Qualification Statements:

1. The sub-contractor shall submit documentation that within the past 12 months, a minimum of 75% of all installation personnel have been trained or certified by the manufacturer of the products they are installing.

## 1.08 CLOSEOUT SUBMITTALS

### A. As-Built Drawings:

- 1. Submit all as-built drawings in accordance with the general requirements of the construction documents.
- 2. Submit as-built drawings a minimum of two (2) weeks after completion of all Division- 27 work for A/E and Owner reference:

## 1.09 QUALITY ASSURANCE

### A. Qualifications – Manufacturer

 Component manufactures shall be ISO 9001:2000 and offer products that are RoHS compliant.

#### B. Qualifications – Installer:

 At a minimum, seventy-five percent (75%) of the onsite sub-contractor provided field technicians shall be factory certified within 12 months by the manufacturer of the selected telecommunications system components being installed. Proof of certification shall be available on site for review at all times for each field technician.

## PART 2 - PRODUCTS

## 2.01 COPPER UTP PATCH CORDS

- A. Basis-of-Design Product: Subject to compliance with requirements:
  - 1. Leviton:
    - a. TR Patch Cords Atlas-X1 Cat6A Slimline Black
      - 1) Part Number 6AS10-05E (5') (E=Black)
      - 2) Part Number 6AS10-07E (7') (E=Black)
    - b. Station Patch Cords Atlas-X1 Cat6A Slimline Blue
      - 1) Part Number 6AS10-xxL (xx=3,5,7,10,15,20 Feet) (L=Black)

# B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each assembly selected shall address the particular infrastructure requirements.

## C. Description:

Category UTP Copper patch cords for equipment patching (RJ-45 to RJ-45 Cords): Modular RJ45 male plug connector's equipped with (8) eight gold anodized pins shall be factory terminated at each end of the patch cords.



- Modular plug connectors will be snag free in design or will utilize a molded plastic boot to cover the modular plug tab. Category 6A UTP cords shall be 26 AWG.
- 2. All patch cords shall conform to the requirements of the EIA/TIA 568C.2 standard performance parameters and shall also guarantee headroom margin above the minimum EIA/TIA 568C standard NEXT and PSNEXT requirements; and shall provide positive ACR to 5000 MHz-km as part of the connectivity system.
- 3. All copper UTP patch cords shall have stranded conductors that match the EIA/TIA 568-C performance characteristics of the category cable specified.
- 4. Patch cord performance levels shall be equal to or greater than the performance level of the installed UTP cabling system.
- 5. All copper patch cord lengths for patching inside the telecom rooms are to be provided appropriate to patching from network equipment ports to the copper patch panels ports within the Data Center and IDF.

# D. Accessory Products:

- 1. Provide any accessory products related to the UTP connectors required to provide a complete and functional infrastructure system.
- 2. Port RJ-45 patch cord lock-in device to safely secure access to patched cords and deter accidental removal to network connection.
- 3. Provide complete with all required mounting hardware and fittings and cables needed.

#### 2.02 OPTICAL FIBER PATCH CORDS

- A. Basis-of-Design Product: Subject to compliance with requirements:
  - 1. AFL/Dura-Line

## B. Product Options:

1. The indicated manufacturers shall be the basis of the design and each assembly selected shall address the particular infrastructure requirements.

# C. Description:

- All optical fiber patch cords shall conform to the requirements of the EIA/TIA 568C.3- 1 standard performance parameters for the multimode or single-mode optical fiber and shall have the same manufacturer, cable type, connector and polish as noted for the backbone fiber.
- 2. All optical patch cords shall have push-pull strain relief boot and duplex clip.
- All optical fiber patch cord lengths are to be provided appropriate to patching from network equipment ports to the optical fiber patch panels ports within the MDF and IDF.
- 4. It is the responsibility of the Sub-contractor to verify lengths and counts of optical fiber patch cords with the owner prior to purchase.
- 5. All single-mode patch cord colors are to be industry standard yellow and provided in a duplex configuration.
- 6. All multi-mode patch cord colors are to be industry standard aqua and provided in a duplex configuration.
- 7. Any optical fiber patch cords purchased without written authorization by the Owner are purchased at the sub-contractors own risk.

# D. Accessory Products:



1. Provide any accessory products related to the optical fiber connectors required to provide a complete and functional infrastructure system.

## PART 3 - EXECUTIONEXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
  - 1. Electrical requirements (conduit installation and capacity)
  - 2. The telecommunications rooms are the size shown on the project drawings.
  - 3. Adequate clearances of doors, riser spaces and ceilings for all component of the telecommunications system.
  - 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

## 3.02 INSTALLATION

#### A. Process:

- 1. Install all horizontal cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA 568 C and BICSI.
- 2. Category 6A equipment Patch cords: Provide (2) copper patch cords (one for each end of the cable termination) for every Category cable installed.
- 3. Fiber Optic equipment Patch cords: Provide (2) fiber optic LC duplex patch cords (one for each end of fiber termination) for every pair of fiber strands installed.
- 4. All patch cord lengths are to be provided appropriate to patch from rack mounted network equipment ports to the rack mounted horizontal station outlet patch panel ports within the Data Center/IDF and from the workstation outlet to the computer/or other IP end device NIC card/RJ45 port.
- 5. Provide new, sealed patch cords in lengths, colors and counts approved in writing by the owner.
- 6. It will be the responsibility of the communication sub-contractor to provide install all Category 6A and Fiber patch cords per direction and coordination of owner IT dept.

#### 3.03 RE-INSTALLATION

A. No additional burden to the owner regarding costs, network down-time, and end user interruption shall result from the re-installation of specified components. Scheduling for re- installation work shall be coordinated, in writing, with the owner prior to beginning any re- installation work.

#### 3.04 CLOSEOUT ACTIVITIES

- A. Sub-contractor shall provide documentation of all telecommunications system components under this section utilized throughout the site for review and reference by the Owner and A/E team.
- B. Sub-contractor to submit all as-built drawings and any test documentation required prior to acceptance by the Owner.



# **END OF SECTION**



#### **SECTION 28 20 00**

## **VIDEO SURVEILLANCE SYSTEM**

#### PART 1 - GENERAL

#### 1.01 DESCRIPTION

#### A. Work Included:

- 1. Under this Section, the Contractor is to provide Video Surveillance System, including procuring, installing, and rendering fully operational all necessary surveillance system components required for a complete and workable installation which meets or exceeds the project performance specifications.
- 2. Equipment to be provided and installed includes, but is not limited to:
  - a. Fixed Pole Mount Mini-dome Type Megapixel Cameras
  - b. Fixed Pole Mount ALPR Cameras
  - c. Power and Data Cabling, Conduit, and Infrastructure to be provided, installed and terminated by the communications contractor
- 3. The work includes providing all labor, materials, tools, equipment, and documentation required for a complete and working surveillance system as specified in this document, unless some portion is specifically noted otherwise.

## B. Related Work Provided by Owner:

- 1. The Contractor shall coordinate the work with the related work provided by the Owner including but not limited to the following:
  - a. Network from local patch panel / switch serving as termination point for the cameras back to the VMS server
  - b. All cabling, cabling terminations, and conduit/boxes/fittings

## C. Abbreviations and Acronyms

- 1. ACS = Access Control System
- 2. ALPR = Automatic License Plate Reader
- 3. CCD = Charge Coupled Device
- 4. CMOS = Complimentary Metal-Oxide Semi-Conductor
- 5. CPU = Central Processing Unit
- 6. DSP = Digital Signal Processor
- 7. DVD = Digital Video Disc
- 8. DVRMS = Digital Video Recording and Management System
- 9. GB = Gigabyte
- 10. GUI = Graphical User Interface
- 11. HDD = Hard Disk Drive
- 12. IR = Infrared
- 13. IPS = Images per Second
- 14. JPEG = Joint Photographic Experts Group
- 15. MB = Megabyte
- 16. MPEG = Moving Pictures Experts Group
- 17. NAS = Network Attached Storage
- 18. LAN = Local Area Network
- 19. LED = Light Emitting Diode
- 20. RAID = Redundant Array of Independent Disks



- 21. RAM = Random Access Memory
- 22. TCP/IP = Transport Control Protocol / Internet Protocol
- 23. UPS = Uninterruptable Power Supply
- 24. POE = Power Over Ethernet
- 25. PVT = Performance Verification Testing
- 26. V-LAN = Virtual Local Area Network
- 27. VMS = See DVRMS
- 28. VSS = Video Surveillance System
- 29. WAN = Wide Area Network
- 30. WDR = Wide Dynamic Range

#### D. Definitions

1. Surveillance System – IP-based electronic system which provides visual surveillance and recording of selected areas.

#### 1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Specifications and Drawings are intended to be complementary. A specific section, paragraph or heading in a Division may not describe all details concerning work to be done and materials to be furnished. The Drawings are diagrammatic and may not show all of the work required or all construction details. Dimensions are shown for critical areas only; all dimensions and actual placements are to be verified in the field. It is to be understood that the best trade practices of the Division will prevail. It remains the responsibility of the Contractor or Subcontractor to provide all items, equipment, construction, and services required to the proper execution and completion of the Work.
- C. Reference listings are provided as a convenience to the Contractor or Subcontractor providing the Work of this Section and may not contain all the requirements affecting this Section. It remains the responsibility of the Contractor or Subcontractor to locate and comply with all requirements of the Contract Documents.
- D. All related specification sections shall be used in conjunction with this section.

## 1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The manufacturer of all equipment installed as a part of this contract shall meet the following criteria:
  - 1. Shall be regularly engaged in the manufacture and assembly of similar type equipment for a minimum of five (5) continuous years preceding the date of this document.
  - Shall have an office staffed with factory trained technicians, fully capable of engineering, supervising installation, system start-up, providing Owner training and supervising of both hardware and software for the all systems installed as a part of this project.
- B. Contractor Qualifications: The Contractor shall meet the following qualifications at a minimum:



- 1. Shall be an authorized factory trained and certified reseller of all system components installed or interfaced with as a part of this contract.
- 2. Contractor shall be regularly engaged in installing similar equipment, and shall have successfully completed 3 systems of a comparable size and scope within the preceding 3 years of the date of this document. These systems must be currently in operation, and the contractor shall supply the following reference information with their proposal:
  - a. Name of Client
  - b. Type of Facility
  - c. System Installed
  - d. Date of Substantial Completion
  - e. Names of Contractor's Key Personnel on Project
  - f. Contact Name, Title, Phone, and Email
- 3. It is expected by the Owner that the same key personnel will execute this project as completed the referenced work. This would include the Project Manager, the Project Engineer, and the Lead Installer. Resumes will be provided for these personnel. If different key personnel are executing this project than executed the reference projects, resumes for these personnel shall be provided for the Owner's approval with the Contractor's bid package.
- 4. Sub-contractors shall provide resumes showing qualification for the specific system that the sub-contractor will be installing / configuring.
- 5. In order to assure system cable plant is warrantied for 20-Years, Contractor shall be certified in the installation of BerkTek Cabling systems. Project installation staff shall be similarly and independently certified as required by the manufacturer..

#### 1.04 SUBMITTALS

### A. General:

- 1. Prior to installing any material related to or required by this section, submit the following information for review.
  - a. Block diagrams of the proposed system and interconnection wiring diagrams showing all connections required between system components.
  - b. A materials list with names of manufacturers, model numbers, and technical information on all equipment proposed. Product technical information sheets for each principal component in the proposed system. Where the data sheet covers a range of material, the specific part number shall be highlighted
  - c. 6 complete sets of operations and maintenance manual for the system products being supplied, provided in 3-ring binders, and 1 complete set submitted in electronic format on DVD. Include complete sets of the equipment operating instructions, installation instructions, and troubleshooting guides.

## B. Testing:

 PVT Plan to be submitted a minimum of 20 working days prior to planned start of PVT procedure.

## C. Close Out:

 Within 10 working days of substantial completion and prior to project closeout, the Contractor shall provide to the Owner a complete set of As-Built drawings, showing any deviation from the original plans and specifications, in mounting location, infrastructure pathway, or any other substantive change.



### 1.05 WARRANTY

#### A. General:

- 1. All equipment and system shall be warranted against defects in material and workmanship for a period of one (1) year from the date of startup. Warranty coverage shall include parts, labor, travel, expenses, and labor to remove/reinstall all products. The warranty document shall be submitted with the Contractor's submittals and shall include details on inclusions and exclusions, deductibles, and availability of extended coverage options, priced for extended coverage in years 2, 3, and 4 past expiration of the original warranty period.
- 2. Warranty service shall be separated into 2 classes of service, critical item service and non-critical item service.
- 3. Critical items shall be described as any part or device, included as a part of this contract which if fails would cause major parts of the system to be inoperable. Critical failures are to be corrected within 24 hours of notification to the Contractor, 7 days per week. Non-critical failures are to be corrected within 7 days of notification to the Contractor.

#### PART 2 - PRODUCTS

# 2.01 ACCEPTABLE MANUFACTURERS

- A. Video Surveillance System Equipment:
  - 1. WV-SF481 Exterior Rated 4K Resolution Dome Camera as manufactured by Panasonic. This device is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, camera shall be as specified with no equivalent.
  - 2. PPM484S Wall/Pole Mount Assembly as manufactured by Panasonic. This device is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, camera shall be as specified with no equivalent.
  - 3. IZA500W ALPR Camera as manufactured by Inex. This device is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, camera shall be as specified with no equivalent.
  - 4. MNT-W3X-PMA Pole Mount Adapter Kit as manufactured by Inex. This device is being installed as part of an expansion to an existing District system, and in order to assure compatibility as well as simplify maintenance procedures and spare parts procurement, camera shall be as specified with no equivalent.
  - 5. All servers, workstations, and storage hardware shall be provided by the Owner. All software shall be provided, installed, and configured by the Contractor.
  - 6. Network Switch / Patch Panel at termination point shall be provided by the Owner.
  - 7. All cabling and cabling terminations shall be provided by the communications contractor.

# PART 3 - EXECUTION

3.01 General Intent – It is the intent of the owner to have a qualified contractor install a complete and fully operational Video Surveillance System, as shown on the project



drawings provides the ability to remotely view and record select areas of the campus as indicated on the project drawings.

- 3.02 The contractor shall procure, provide, install, and make fully operational the system as described in this specification and shown on the project drawings. Specific scope items include, but are not limited to:
  - A. Provision, installation, and configuration of surveillance system components as shown on project drawings
  - B. Provision and installation of surveillance system software (Owner to provide workstations and servers)

## 3.03 DELIVERY, STORAGE AND HANDLING:

- A. Product Acceptance, Storage, and Handling Requirements
  - 1. Acceptance Upon delivery to the project site, Contractor shall inspect all products and materials to assure that all products and material have been received in a new and undamaged state. Acceptance of the shipment, by the Contractor, shall constitute acknowledgement that the Contractor has reviewed the products and material and has found no discrepancies in quantity or condition, and that any products or materials subsequently found to be missing or damaged will be the sole responsibility of the Contractor.
  - 2. Storage and Handling Store products and materials in the original manufacturer's sealed packaging, in an environmentally controlled area per the manufacturer's specifications.

# B. Before Beginning Work

- 1. Verification of Conditions Security Contractor shall coordinate with Communications Contractor to assure all installed copper and fiber optic cabling being utilized as a part of the surveillance system is tested and completely operational and that cabling is free from interference, opens, grounds, or short circuits. Any unsatisfactory cabling shall be reported to the Owner.
- 2. Proceed with installation only after all unsatisfactory issues have been corrected or resolved.

# C. General Installation Requirements:

- 1. Maintain strict site security throughout the course of the project. Rooms housing the equipment and workstations shall be locked up and secure during periods when Contractor personnel are not present.
- 2. Utilize protective cover, fenders, and barriers to ensure all equipment remains in an undamaged and new condition until notice of substantial completion.
- 3. Install system per the manufacturer's instructions.
- 4. The installed system must meet all local, state, and federal codes.
- 5. Contractor shall verify that all IDF outlets used for powering video surveillance system components are connected to the buildings emergency power UPS.
- 6. Camera locations shown on drawings are preliminary in nature and Contractor shall verify final placement of all cameras with the Owner before any installation takes place.

## D. Coordination



- 1. Contractor shall coordinate all work with any other trades present on the project which will be directly affected by the execution of this contract.
- 2. Contractor shall coordinate all work with the Owner as to avoid impacting any student activities or classes to the greatest extent possible.

# E. Testing and Commissioning:

- 1. The Contractor shall be responsible for final system hardware installation, configuration and checkout prior to performance verification testing being conducted with the Owner.
- 2. The Contractor shall develop a Performance Verification Testing (PVT) plan. The PVT plan shall identify each new system component included in the project, the intent of testing it, methods and tools required for the testing, and expected result. Each component shall be individually listed with space for noting PASS or FAIL, Contractor / Owner Sign-off, time and date of test, and related comments. The PVT plan shall be submitted to the Owner a minimum of 20 (TWENTY) working days prior to the scheduled beginning of PVT. No testing shall take place until Owner has approved the PVT.
- 3. As a part of the final system commissioning, Contractor shall submit a listing of all enabled passwords within the system, and shall provide instruction specific to changing the password after the Contractor's departure from the site.
- 4. Following satisfactory completion of PVT plan, the system shall be operated at normal facility load for a period of 30 calendar days as a burn-in period. If any item or system fails during the burn-in period, the burn-in period shall be suspended until such item or system has been corrected, at which time the test period will recommence. Notice of final System Acceptance will be withheld until burn-in period has been successfully completed.
- 5. Notice of Final System Completion will not be issued until the following requirements have all been met:
  - a. All required submittals accepted.
  - b. Delivery of final documentation, including but not limited to As-Builts drawings.
  - c. Successful PVT & burn-in period
  - d. Completion of all required training activities.
  - e. Purging of all Contractor passwords and removal of all Contractor access to the systems.

# F. Training and Instruction:

- Before the system is turned over to the owner, the manufacturer shall provide 16
  hours of system operations and maintenance training at the project site using the
  customer's equipment for up to 10 of the owner's representatives. The Owner shall
  determine hours to be allocated to each training type.
- 2. This training shall be conducted during normal business hours of the equipment supplier at a date and time of mutual convenience.
- 3. This training shall be conducted by a manufacturer certified trainer.
- 4. Training materials shall not be generic, and shall be specific to the project.

## G. Warranty:

1. The system shall be warrantied for a period of 1 year from date of acceptance. Written notification shall be sent to the owner stating the date this warranty period has started.



- 2. The equipment manufacturer shall provide with their bid package to the owner a maintenance contract proposal to provide a minimum of two inspections and preventative tests per year.
- 3. The Contractor shall provide with their bid package to the Owner a proposal for an extended parts and labor warranty service, priced for the 1st, 2nd, and 3rd years of post-warranty period operation.

# H. Site Clean-up

1. Upon completion of the contract, Contractor shall be responsible for project site cleanup. All installed materials shall be clean, enclosures free of dust and debris, and surfaces wiped free of smudges and fingerprints. The Contractor shall remove all project associated debris and rubbish occasioned by the work from the site. The contractor shall clean all interior spaces dirtied by the work. Remove all temporary protective covers and shrouds from all equipment.

# **END OF SECTION**



# **SECTION 31 10 00**

#### SITE CLEARING

# PART 1 - GENERAL

### 1.01 SECTION INCLUDES

- A. Remove surface debris.
- B. Remove paving, curbs, foundations and surface improvements.
- C. Clear site of plant life and grass.
- D. Remove trees and shrubs.
- E. Remove root system of trees and shrubs.
- F. Temporary Erosion and Sedimentation Control
- G. Post Construction Stormwater Management.
- H. Related Section
  - 1. Section 01 35 43, Special Environmental Requirements.

## 1.02 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

# 1.03 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for disposal of debris. Burning debris on site not permitted.
- B. Coordinate clearing work with utility companies.
- C. No site clearing may take place without required Biological, Cultural and Paleological monitors notified and present if required.

### PART 2 - PRODUCTS

### 2.01 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earthwork."
  - Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.



B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

### PART 3 - EXECUTION

### 3.01 PREPARATION

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

#### 3.02 PROTECTION

- A. Protect utilities that are designated to remain from damage.
- B. Protect trees, plant growth and features designated to remain as final landscaping.
- C. Protect bench marks and designated existing structures from damage or displacement.
- D. Erect barricades in accordance with Title 8, Subchapter 4, Construction Safety Orders, California Code of Regulations.
- E. Protect existing items not indicated to be altered.

#### 3.03 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove paving, curbs, foundations and surface improvements. Patch and repair surfaces not indicated to be removed.
- C. Remove trees and shrubs indicated. Remove stumps, main root ball, root system to full depth.
- D. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
- E. Clear undergrowth, grass and deadwood. Protect plant material not scheduled for removal.
- F. Keep site free of dust by sprinkling with water. Maintain adequate water trucks, hoses and water supply.
- G. The limits of clearing and grubbing shall be the area of new construction
- H. Remove all trash, rubbish and all other material not suitable for construction operations.
- I. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.



- J. Use only hand methods for grubbing within tree protection zone.
- K. Chip removed tree branches and [stockpile in areas approved by Owner dispose of off-site.
- L. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground or compact to 90 percent of maximum dry density per ASTM D1557. Bring grade to match surrounding surfaces.

# 3.04 REMOVAL

- A. Remove debris, rock and extracted plant life from site as work progresses. Dispose legally.
- B. Burial of removed materials not permitted.
- C. Use of Owner's disposal system not permitted. Do not use disposal system belonging to any other property Owner.
- D. Loose fill material, buried trash, abandoned underground structures or deleterious materials of any kind encountered shall be identified and removed to expose natural earth.

# **END OF SECTION**



# **SECTION 31 22 00.10**

### **EARTHWORK**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

A. Earth preparation outside building areas.

# 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. California Code of Regulations, Title 8, Industrial Relations, Construction Safety Orders, Division 1, Chapter 4, Subchapter 4, Article 6 Excavations.
- C. 2016 California Building Code Chapter 18 "Soils and Foundation"
- D. Cal-OSHA: California Occupational Safety and Health Act, Title 8, Division 1, Chapter 3.2.
- E. ASTM D 1557 Laboratory compaction characteristics of soil using modified effort.

## 1.03 SUBMITTALS

A. Compaction Report indicating requirements per ASTM D1556.

B.

# 1.04 GENERAL REQUIREMENTS

- A. Existing Conditions: Contractor shall examine site of Work and verify existing conditions under which work will be performed, including subsurface conditions.
- B. Repair or replace property damaged by Work of this Section immediately.
- C. Drainage and Pumping: Maintain excavations and site free from water throughout work. Run surface water or seepage to sumps with float-switch controlled pumps. Pump to temporary desilting basins.
- D. Protection: Provide and maintain protection to retain earth banks and protect adjoining existing monuments, grades and structures from caving, sliding, erosions or other damage and suitable forms of protection against bodily injury or property damage.
- E. Bulkheads and shoring shall conform to Occupational Safety and Health Act Construction Safety Orders, Title 8, Industrial Relations, California Code of Regulations.
- F. Provide barricades and berms at top of slopes to prevent water from flowing over top.

- Geotechnical Investigation Report has been prepared under direction of Owner. Geotechnical Investigation Report is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw from information provided. Contract Documents take precedence over recommendations that may be contained in the Investigation Report and Contractor must obtain approval for deviations from Contract Documents. Copy of Geotechnical Investigation Report is available at Architect's office.
- H. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with California EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - Testing Frequency
    - a. For borrow up to 1,000-cu.yd, conduct 1 test for each 250-cu.yrds.
    - b. For borrow between 1,001- and 5,000-cu.yd; conduct 4 tests for first 1,000-cu.yd., if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
    - c. For borrow over 5,000-cu.yds, conduct 12 tests during import of first 5,000-cu.yd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yds.
  - 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
  - 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
  - 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
  - 5. Do not import soils that exhibit a known risk to human health, the environment, or both.

## PART 2 - PRODUCTS

## 2.01 MATERIALS

A. Excavated material, Imported Fill and Backfill: As specified in Section 31 23 23 and as approved by Geotechnical Engineer prior to placement on site.

# PART 3 - EXECUTION

#### 3.01 PRE-CONSTRUCTION INSPECTION

- A. Inspection of Site: Inspect entire site prior to commencing work and determine character of materials to be encountered and all conditions affecting Work.
- B. Existing Site Conditions: Verify location of existing underground structures and utility facilities (if any) and take adequate precautions to avoid damage to any active service or structure.
- C. Piping and conduit encountered shall be adequately supported and protected until permanent support is provided or removal of same is approved by Architect.



- D. Existing Utilities: After approval of Architect, totally remove abandoned pipes and utilities found in excavations.
- E. Support and protect existing pipes and conduits where required during construction.
- F. Site Clearing: Conform to Section 31 10 00.
- G. Loose fill and natural on-site soils that are approved by Geotechnical Engineer may be, processed, stock-piled and used as fill material.
- H. After clearing and removal of loose fill, exposed surfaces shall be processed, inspected and approved by Geotechnical Engineer prior to placing fill.
- I. Backfilling: Conform to Section 31 23 23.

# 3.02 STAKING AND GRADES

A. Refer to Section 01 70 00 Field Engineering.

\*\*\*OR\*\*\*

- B. Lay out work, establish necessary control markers, bench marks, grading stakes, and other stakes as required.
- C. Existing and finish elevations are shown on the drawings, and unless inconsistencies therein are brought to the attention of the Architect in writing prior to commencement of the construction, the Contractor will be held responsible for the proper location and elevation of all work.

# 3.03 EXECUTION

- A. Building areas shall be those areas indicated on grading plan that includes building area and distance of 5 feet minimum beyond footing lines, including covered walks. Excavation for building areas shall be as specified in Section 31 23 16 In both cut and fill areas, over-excavate and remove loose existing soils to depths required by the Geotechnical Investigation Report or Geotechnical Engineer's recommendations as needed.
- B. Geotechnical Engineer shall inspect all over-excavated areas prior to completion of area processing and before moving on to other areas..
- C. After approval has been received from Geotechnical Engineer to proceed, bring soil mix to optimum moisture content and re-compact to 90 percent of maximum dry density per ASTM D 1557. Geotechnical Engineer shall test and approve results. Bring grade to sub-grades indicated or to interim working conditions, if needed, in 8 inches maximum loose lifts for materials compacted by heavy equipment and not more than 4 inches loose depth for materials compacted by hand equipment to sub-grades indicated as follows:
  - 1. Structural Fill: Use under foundations, slabs on grade in layers as indicated.



- 2. Drainage Fill: Use under designated building slabs, at foundation drainage and elsewhere as indicated.
- 3. Common Fill: Use under unpaved areas.
- 4. Subbase Material: Use under pavement, walks, steps, piping and conduit.
- D. . Compact to 90 percent of maximum dry density per ASTM D1557.
- E. Grading at Asphaltic Concrete Areas: Rough grade soil to elevation to conform to specified depth of base and pavement.
- F. Place necessary fill to bring sub-grade to proper elevations. Fill shall be placed as Compacted Fill.
- No jetting or flooding permitted. G.

#### 3.04 **INSPECTION**

- Grading operations shall be inspected by Geotechnical Engineer. No fill shall be Α. placed on any prepared surface until that surface has been inspected and approved by Geotechnical Engineer.
- Completed earthwork including cuts, fills, and earth bank slopes (cut or fill) shall be B. inspected by Geotechnical Engineer to determine suitability of exposed soils.

#### 3.05 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled while it is frozen or thawing or during unfavorable weather conditions. When Work is interrupted by heavy rain, fill operations shall not be resumed until field tests by Geotechnical Engineer indicate that moisture content and density of fill are as previously specified.

#### 3.06 **EXCAVATION FOR FOUNDATIONS**

A. Conform to Section 31 23 16.

#### 3.07 **EARTH SLOPES**

- A. Earth slopes shall be sloped to 2 (horizontal) to 1 (vertical) maximum. Tops of slopes shall be bermed to prevent surfaces water from running off over slopes. Tops of earth slopes shall be level to distance of 5 feet minimum from existing structures and 5 feet minimum behind construction barricades adjacent to driveways.
- B. Earth slopes shall maintain a minimum clearance from existing or proposed foundations as illustrated in Figure 1808.7.1 of 2016 CBC.

#### 3.08 **TOLERANCES**

Perform rough grading to grades indicated, plus or minus 0.1 foot. Where grades are Α. not indicated, grade uniformly level or slope between points for which elevations are



given or from such points to existing grades with due allowance for adequate drainage and subsequent materials.

#### 3.09 TRENCHING FOR UTILITIES

Α. Conform to Section 31 23 17.

#### 3.010 STOCKPILING OF FILL MATERIAL

- Α. Fill: Soil removed that is suitable for fill shall be temporarily stockpiled separately on site.
- B. Stockpile Locations: Materials shall be stockpiled in locations approved by Architect and convenient for future placing, causing least disturbance to site and away from areas of actual building construction.
- C. Stockpiles to remain on site longer than 15 days without use shall be covered to prevent any form of erosion.

#### 3.011 FIELD QUALITY CONTROL

- Testing and Inspection: Owner will engage a qualified independent Geotechnical Α. Engineer to perform field quality-control testing and inspections. Do not proceed with concrete placement without approval of Geotechnical Engineer.
- B. Testing agency will test compaction of soils in place according to ASTM D1556, and ASTM D2937 as applicable. Tests will be performed at the following locations and frequencies:
  - Paved Areas: At sub-grade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area, but in no case fewer than 3 tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
- C. Frequency of Tests: Geotechnical Engineer may make as many tests as are necessary to ensure specified results.
- When testing agency reports that sub-grades, fills, or backfills have not achieved D. degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

#### 3.012 DISPOSAL OF EXCESS MATERIAL

Legally dispose off excess materials. Disposal shall be in areas off Owner's property, Α. unless otherwise approved by Architect.

#### **END OF SECTION**



# **SECTION 31 22 01**

### LANDSCAPE FINISH GRADING

# PART 1: GENERAL

### 1.01 EXISTING CONDITIONS

- A. Known underground, surface and aerial utility lines, and buried objects are indicated on the Drawings. The contractor is responsible for verifying the locations of all underground utilities prior to beginning work on the project.
- B. Verify site conditions and note irregularities affecting work of this Section.
- C. Do not hold Owner liable for extra charges for conditions uncovered and not shown or described in the Contract Documents, without acceptance of Landscape Architect.
- D. Beginning work of this Section means acceptance of existing conditions.

#### 1.02 PROTECTION

- A. Protect trees, shrubs and lawn areas to remain and other features remaining as part of final landscaping.
- B. Protect bench marks, existing structures, fences, roads, sidewalks, paving and curbs against damage from equipment and vehicular traffic.
- C. Protect aerial, surface, or underground utility lines or appurtenances that are to remain.
- D. Provide all necessary barricades.
- E. Repair any damage at no cost to owner.
- F. Prevent soil and debris from entering any streams, ditches, or sewers.

# PART 2: PRODUCTS

### 2.01 SOIL AMENDMENTS

A. Soil amendments shall be as specified in sections 32 93 00.

# PART 3 - EXECUTION

3.01 ESTABLISH AND IDENTIFY REQUIRED LINES, LEVELS, CONTOURS, AND DATUM

# 3.02 SUBSOIL PREPARATION

A. Prior to beginning finish grading, assure that subsoil elevations are to a reasonable true and even plane at the required elevations, with due allowance for seed and planting beds.



- B. Adjust discrepancies in elevations of subsoil to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- C. Clear subgrade surface of stones in excess of 1/2 inch, debris, and rubbish. Remove subsoil contaminated with petroleum products.
- D. Cultivate or scarify subgrade to a depth as noted in sections 32 93 00. Repeat cultivation in areas where equipment has compacted subsoil.
- E. Finish grade to contours and spot elevations shown on the plans. Smoothly transition all breaks in grades. Establish final drainage flow lines and gradients for uniform water drainage from high points to drainage outlets or inlet structures.
- F. Finish grade for planter areas shall be 2" below sidewalk elevations, except at locations that drainage water will flow onto or across hardscape, curbs or paving. At these conditions the grades shall be flush or no more than 1/2" below hardscaping. Finish grades shall be of uniform slope and grade between points of fixed elevations or elevation controls. Finish grades shall be established from such points.
- G. All finish grades shall be floated to assure a uniform surface without irregular dips or ridges.
- H. All fill areas and constructed berms or mounds in future planting areas shall be compacted in even levels to a <u>maximum</u> compaction of 80%, with allowance for settlement.

#### 3.03 RESTORATION OF ADJACENT AREAS

A. Where adjacent lawn or surface areas within project site, but outside grading limits, are disturbed as a result of building operations or storage of materials under this contract, clean these areas of all debris and restore to original grades and to a condition equal or better than originally received.

# 3.04 CLEAN-UP

- Remove excess soil from site.
- B. Leave stockpile areas clean, raked and ready to receive landscaping.
- C. Remove any soil which may have been brought onto paved surfaces by hauling and grading operations.

# 3.05 MAINTENANCE OF GRADES

- A. Protect newly graded areas from traffic and erosion, and keep free of trash and debris.
- B. The Contractor shall submit to the Architect for review, his plan of operation for accomplishing temporary and permanent erosion control. The plan shall include such items as:



- 1. Location and construction of temporary berms, dikes, dams, ditching or sediment basins.
- 2. Any temporary cover crops proposed.
- 3. Placement of permanent erosion control features relative to construction sequences and progress.
- C. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

**END OF SECTION** 



### **SECTION 31 23 15**

# **EARTHWORK-PORTABLES**

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

- A. Earth preparation under portables building area. Extend 5 feet from building perimeter, all sides.
- B. Related Sections:
  - 1. Section 05 52 00, Handrails and Railings
  - 2. Section 31 10 00, Site Clearing
  - 3. Section 31 23 23, Backfilling
  - 4. Section 32 12 17, Asphalt Concrete
  - 5. Section 32 13 13, Sitework Concrete

### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM D1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10 lb. rammer and 18 inch drop.

## 1.03 GENERAL REQUIREMENTS

- A. Existing Conditions: Contractor shall examine the site of the work and verify existing conditions under which work will be performed, including subsurface conditions.
- B. Drainage and Pumping: Maintain excavations and site free from water throughout work. Run surface water or seepage to sumps with float-switch controlled pumps. Pump to drainage system as approved by Architect.
- C. Protection: Provide and maintain protection to retain earthbanks and protect adjoining existing monuments, grades and structures from caving, sliding, erosions or other damage and suitable forms of protection against bodily injury or property damage.
- D. Bulkheads and shoring shall conform to Occupational Safety and Health Act Construction Safety Orders, Title 8, Industrial Relations, California Code of Regulations.
- E. Provide barricades and berms at top of slopes to prevent water from flowing over top.



#### 1.04 QUALITY ASSURANCE

- A. Borrow, Fill, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - 1. Testing Frequency
    - a. For borrow conduct 1 test for each 250-cu.yrds.
  - 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
  - 3. Conduct tests for lead and other heavy metals, asbestos, PCB's pesticides, herbicides, VOC's, and semi-VOC's.
  - 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
  - 5. Do not import soils that exhibit a known risk to human health, the environment, or both.

# PART 2 - PRODUCTS

# 2.01 FILL MATERIALS

- A. Imported Fill: Clean granular, free of debris, no rock larger than 3 inches in any dimension, non-expansive, approved by Geotechnical Engineer prior to placement on site.
- B. Loose fill and natural on-site soils that are approved by the Geotechnical Engineer may be stock-piled and used as fill material.

# PART 3 - EXECUTION

# 3.01 PRE-CONSTRUCTION INSPECTION

- A. Inspection of the Site: Inspect the entire site prior to commencing work and determine the character of the materials to be encountered and all conditions affecting the work.
- B. Existing Site Conditions: Verify the location of all existing underground structures and facilities and take adequate precautions to avoid damage to any active service or structure.
- C. Repair or replace all property damaged by the work of this section immediately.
- D. Piping and conduit encountered shall be adequately supported and protected until permanent support is provided or removal of same is approved by the Architect.
- E. Existing Utilities: After approval of Architect, totally remove abandoned pipes and utilities found in excavations. Cap or plug at both ends all abandoned utility piping, conduit and lines encountered to provide a complete seal. Provide plugs or seals of concrete or threaded caps unless otherwise approved.

- F. Support and protect existing pipes and conduits where required during construction.
- G. Site Clearing: Conform to Section 31 10 00.
- H. Loose fill and natural on-site soils that are approved by the Inspector may be stock-piled and used as fill material.
- I. After clearing and removal of loose fill, the exposed surfaces shall be inspected and approved by Testing Laboratory prior to placing fill.

# 3.02 SITE PREPARATION

- A. The building areas shall be those areas indicated on the site plan which include the building areas and a distance of 5 ft minimum beyond building lines, including covered walks and 6 ft in front of portable buildings for ramp installation.
- B. Remove existing turf, scarify exposed soil to 6 inches below grade. After approval has been received from Inspector of Record to proceed, bring to optimum moisture content and re-compact to 90 percent of maximum dry density per ASTM D1557.
- C. Bring to grades indicated on drawings in 6 inch lifts, compact to 90% of maximum dry density per ASTM D1557.
  - 1. Provide imported soils or approved stock-piled fill material to pad levels.
- D. Geotechnical Engineer shall inspect scarified areas and compacted areas.
- E. Bring building pad to elevations specified. Slopes of building pad shall not exceed 1/8 per foot diagonally.
- F. Inspector shall inspect pad areas.

# 3.03 INSPECTION

- A. Grading operations shall be inspected by the Inspector. No fill shall be placed on any prepared surface until that surface has been inspected and approved by the Inspector.
- B. Completed earthwork including cuts, fills, and earth bank slopes (cut or fill) shall be inspected by the Inspector to determine suitability of exposed soils.



#### 3.04 SEASONAL LIMITS

A. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the **Geotechnical Engineer** indicate that the moisture content and density of the fill are as previously specified.

# 3.05 TOLERANCES

- A. Perform rough grading to grades indicated, plus or minus 0.1 foot. Where grades are not indicated, grade uniformly level or slope between points for which elevations are given or from such points to existing grades with due allowance for adequate drainage and subsequent materials.
- B. Grading at Asphaltic Concrete Areas: Rough grade soil to an elevation to conform to specified depth of base and pavement.
- 3.06 TRENCHING FOR UTILITIES
  - A. Conform to Section 31 23 17.
- 3.07 STOCKPILING OF FILL MATERIAL
  - A. Fill: Soil removed that is suitable for fill shall be stockpiled separately on the site.
  - B. Stockpile Locations: Materials shall be stockpiled in locations approved by the Owner and convenient for future placing, causing the least disturbance to the site and away from areas of actual building construction.
- 3.08 DISPOSAL OF EXCESS MATERIAL
  - A. Legally dispose of excess materials. Disposal shall be in areas off the Owner's property, unless otherwise approved by the Architect.

# **END OF SECTION**



# **SECTION 31 23 16**

### **EXCAVATION**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Earth preparation within building area.
- B. Excavation for building foundations.

# 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort.
- C. California Public Contract Code, Section 7104 Public Works Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contract.
- D. California Labor Code, Section 6705 Public Works Contracts requiring detailed plans for shoring, bracing, sloping, indicating protection from caving ground for trenching work in excess of 5' deep and contract amounts stipulated therein.
- E. Standard Specification for Public Works Construction "Green Book", 2015 edition

# 1.03 SUBMITTALS

A. Compaction Report indicating requirements per ASTM D1556.

B.

# 1.04 QUALITY ASSURANCE

- A. Verify that survey benchmark and intended elevations for the Work are as indicated.
- B. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - 1. Testing Frequency
    - a. For borrow up to 1,000-cu.yrd, conduct 1 test for each 250-cu.yrds.
    - b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.



- c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
- 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
- 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
- 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
- 5. Do not import soils that exhibit a known risk to human health, the environment, or both.]

# 1.05 SOILS INFORMATION

A. Geotechnical Investigation Report has been prepared under direction of Owner. The Geotechnical Investigation Report is hereby referenced as information for Work of this Section. Architect assumes no responsibility of, or conclusions Contractor may draw from information provided. Contract Documents take precedence over recommendations that may be contained in Geotechnical Investigation Report and Contractor must obtain approval for any and all deviations from Contract Documents. Copy of Geotechnical Investigation Report is available at Architect's office.

# PART 2 - PRODUCTS

A. Structural Backfill material shall conform to Green Book section 217-3.

# PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Identify known underground, above ground and aerial utilities. Stake and flag locations.
- C. Notify utility company to remove and relocate utilities where required for construction operations.
- D. Protect above and below grade utilities that are to remain.
- E. Protect plant life, lawns and other features remaining as portion of final landscaping.
- F. Protect bench marks, existing structures, fences, sidewalks, paving and curbs from excavation equipment and vehicular traffic.

### 3.02 BUILDING AREA PREPARATION

- A. Within building area and to distance of 5 feet beyond exterior footings or covered walks, remove existing fill or loose natural soils (sub excavate) to a depth recommended by Geotechnical Engineer or 12 inches below bottom of footing whichever is greater. Exposed surface shall be inspected by Geotechnical Engineer. Additional unsuitable soil, as directed by Geotechnical Engineer shall be removed.
- B. Scarify exposed surface to depth of 6 inches. Bring to optimum moisture content and compact to 90-percent maximum ASTM D1557 laboratory density.
- C. Add approved fill to required subgrade elevation in 8 inch maximum lifts. Bring to optimum moisture content and compact to minimum 90-percent of maximum ASTM D1557 laboratory density.
- D. Structural Fill shall be used in foundation trenches as specified in Section 31 23 23 and as approved by Geotechnical Engineer.

### 3.03 EXCAVATION FOR FOUNDATIONS

- A. Conform to Public Contract Code, Section 7104 for excavations that extend more than four feet below the surface.
- B. Conform to Section 6705, Labor Code. Provide shoring and bracing plans or other provisions intended to prevent caving of ground.
- C. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases. Protect existing monuments, grades and improvements of any kind. Remove all obstructions to the work.
- D. Excavate subsoil to elevations required to accommodate building foundations, slabs-on-grade, construction operations, forms, forms removal and inspection.
  - 1. Side forms in foundation excavations may be omitted where earth remains firm with no cave-in providing one inch is added to footing width for each form removed
  - 2. Finish subgrade to a tolerance of 0.05 foot of within required elevations for subgrade.
- E. Machine slope banks. Earth banks shall be sloped to 2 (horizontal) to 1 (vertical). Tops of earth banks shall be level to a distance of 5 feet minimum from all existing structures, and 5 feet minimum behind all construction barricades adjacent to driveways.
- F. Excavation cut shall not interfere with normal 45 degree bearing splay of foundation.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Hand trim excavation. Remove loose matter. Machine tamp bottom of excavation.
- I. Remove lumped subsoil, boulders, and rock 3 inches in size or larger.

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- J. Notify Geotechnical Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- K. Correct unauthorized excavation.
- L. Correct areas over-excavated by error by filling with the specified concrete.
- M. Stockpile approved excavated material in area designated on site and remove excess material not being reused from site.
- N. Bulkheads and shoring shall conform to Title 8, Industrial Relations, California Code of Regulations, Construction Safety Orders.

# 3.04 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent Geotechnical Engineer to perform field quality-control testing and inspections. Do not proceed with concrete placement without approval of Geotechnical Engineer.
- B. Testing agency will test compaction of soils in place according to ASTM D1556, and ASTM D2937 as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of building slab, but in no case fewer than 3 tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
- C. Frequency of Tests: Geotechnical Engineer may make as many tests as are necessary to ensure specified results.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### 3.05 PROTECTION

- A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing or excessive water inundation.

### **END OF SECTION**



### **SECTION 31 23 17**

#### **TRENCHING**

# PART 1 - GENERAL

### 1.01 SECTION INCLUDES

- Excavate trenches for utilities.
- B. Compacted bedding.
- C. Backfilling and compaction to required elevations.
- D. Slurry concrete.

# 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM C150 Portland Cement.
- C. ASTM C494 Chemical Admixtures for Concrete.
- D. ASTM D1557 Laboratory compaction characteristics of soil using modified effort.
- E. SSPWC Standard Specifications for Public Works Construction, Latest Edition.
- F. California Code of Regulations, Title 8, Industrial Relations, Construction Safety Orders, Division 1, Chapter 4, Subchapter 4, Article 6 Excavations.
- G. Cal-OSHA: California Occupational Safety and Health Act, Title 8, Division 1, Chapter 3.2.
- H. California Public Contract Code, Section 7104 Public Works Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contract.
- I. California Labor Code, Section 6705 Public Works Contracts requiring detailed plans for shoring, bracing, sloping, indicating protection from caving ground for trenching work in excess of 5' deep and contract amounts stipulated therein.

# 1.03 SUBMITTALS

A. The Contractor shall submit in advance of excavation, for acceptance by the Owner's civil or structural engineer, detailed plan(s) showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of trenches more than 10 feet in depth. If such plan(s) varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer.

#### **QUALITY ASSURANCE** 1.04

- Α. Verify survey benchmark and intended elevations for Work.
- B. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - **Testing Frequency** 
    - For borrow up to 1,000-cu.yd, conduct 1 test for each 250-cu.yrds.
    - For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.vrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
    - For borrow over 5,000-cu.yrds, conduct 12 tests during import of first C. 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
  - 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
  - Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, 3. herbicides, VOCs, and semi-VOCs.
  - 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
  - 5. Do not import soils, that exhibit a known risk to human health, the environment, or both.

#### 1.05 **SOILS INFORMATION**

Geotechnical Investigation has been prepared under direction of Owner. Investigation Α. is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw from information provided. The Contract Documents take precedence over recommendations that may be contained in the Investigation and the contractor must obtain approval for any and all deviations from the Contract Documents. Copy of investigation is available at Architect's office.

# PART 2 - PRODUCTS

#### 2.01 FILL AND BEDDING MATERIALS

- Α. Sand shall consist of natural or manufactured granular material, or a combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended. Conform to Subsection 200-1.5.5. SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.
- B. Imported Fill: Granular, free of debris, no gravel larger than 3 inches in any dimension, non-expansive, approved by the Architect prior to placement on the site.
- C. Slurry Concrete:

- 1. Slump: Between 4 inches and 6 inches.
- 2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
- 3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).
- 4. Admixture: Calcium Chloride free, in proportions not to exceed the manufacturer's recommendations.
- 5. Artificial Coloring: ASTM C494. Mix in Mapico Red pigment, proportions as recommended by the manufacturer, L.M. Scofield or equal.
- 6. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.
- D. Stockpiled Fill: Onsite soils, stored separately on the site, approved for re-use by the Architect.

### 2.02 ACCESSORIES

- A. Underground Warning Tape: Metallic Detection Tape, aluminum core, 6 inches wide AASHTO specification colors, by Safety Sign Company, Cleveland, OH, or equal.
- B. Color Coding and Lettering: as required for type of underground utility.

### PART 3 - EXECUTION

# 3.01 EXAMINATION

A. Verify fill material to be reused is acceptable to the Geotechnical Engineer.

# 3.02 PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Backfill with approved fill and compact to density equal to or greater than requirements for subsequent backfill material.
- C. Prior to commencement of trenching operations, notify Underground Service Alert of Southern California (800) 422-4133, Monday through Friday, 7:00 A.M. to 5:00 P.M.

# 3.03 EXCAVATION

- A. Conform to Construction Safety Orders, Title 8, CCR, For Sloping, Benching, Shoring, Bracing, Protective Systems, and Shafts.
- B. Conform to Section 7104, Public Contract Code. Promptly notify Owner of any contact with hazardous materials or differing conditions.
- C. Conform to Section 6705, Labor Code. Provide detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of trenches, as required.

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- D. Excavate subsoil required for utilities. Trenches shall be level or parallel to finish grade unless designated on drawings to be installed to specific gradient.
- E. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.
- F. Water, storm drainage piping located in the same trench shall be separated by 24 inches horizontally and vertically, and water line shall be placed on a solid shelf excavated on one side of the common trench. Cross-over water lines shall also be separated 12 inches vertically from storm drainage pipe.
- G. Water and sewer piping shall not be located in the same trench and they shall be separated by 12 inches horizontally and 12 inches vertically minimum.
- H. Excavation shall not interfere with normal 45 degree bearing splay of foundations. Parallel trenches, no closer than 18 inches from building foundations.
- I. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- J. Remove lumped subsoil, boulders and rock.
- K. Correct unauthorized excavation.
- L. Stockpile approved excavated material in area designated on site and remove excess material not being used from site.

#### 3.04 BEDDING

- A. Support pipe and conduit during placement and compaction of bedding fill. Provide uniform bearing along entire length. Conform to Section 306-6, SSPWC.
- B. Bedding: Place and compact materials in continuous layers not exceeding 6 inches compacted depth, ASTM D1557.
- C. Bedding material shall conform to SSPW section 217 and 306-6.

# 3.05 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Fill areas will be inspected, tested and approved by Geotechnical Engineer.
- C. Soil Fill over Bedding: Place and compact material in continuous layers as scheduled, compacted to ASTM D1557.
- D. Backfill material shall conform to SSPW section 217 and 306-12.
- E. Employ placement method that does not disturb or damage conduit, ducts or piping in trench.

- F. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume Work until field tests indicate that moisture content and density of fill are as previously specified.
- G. Remove surplus backfill materials from site and dispose legally.
- H. Leave fill material stockpile areas completely free of excess fill materials.
- I. Minimum Cover Over Piping, Conduits or Duct Banks: 24 inches.
- J. Lay out and install or otherwise confirm invert elevations of all gravity flow systems to avoid conflict with other sub-surface structures or utilities of any kind. Adjust elevations or layout of pipes, conduits or duct banks to permit the required gravity flow.
- K. Jetting for utility trenching compaction may be used outside building perimeter and only when recommended by Geotechnical Engineer, in accordance with Section 306-12.4 SSPWC.
- L. Pressurized piping shall be installed level, or shall be installed parallel to finish grades unless designated on the Drawings to be installed to specific gradients.

### 3.06 TOLERANCES

- A. Top Surface of Backfilling Under Paved Areas: 0.2 ft from required elevations.
- B. Top Surface of General Backfilling: Plus or minus 0.2 ft from required elevations.

# 3.07 FIELD QUALITY CONTROL

- A. Backfill materials and operations will be inspected and approved by Geotechnical Engineer including earth bank slopes (cut or fill).
- B. Tests, analysis and compaction of fill material will be performed in accordance with ASTM D1557.
- C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- D. Frequency of Tests: Geotechnical Engineer may make as many tests as are necessary to ensure specified results.

# 3.08 PROTECTION OF FINISHED WORK

- A. Protect finished Work.
- B. Recompact fills subjected to vehicular traffic.
- 3.09 TEMPORARY PROTECTION OF UNFINISHED WORK



A. Trenching for placement of underground utilities shall be covered and protected with steel trench plates during non-work hours. Adequate warnings and protection indication of open trenches during work hours must be provided for project safety.

### 3.010 SCHEDULE

# A. Storm and Sanitary Piping:

- 1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but no less than 4 inches. Minimum thickness above top of piping, 12 inches, compacted to 90 percent.
- 2. Cover with stockpiled fill in 8-inch lifts to specified subgrade elevations, compact to 90 percent or to 95 percent under vehicle traffic-supporting paved areas.
- 3. Fill: Slurry concrete, 6" cover at top, bottom and sides of pipes at exterior paved areas (at vehicle traffic) where minimum fill cover is less than 12" below finished elevation of paving. Slurry per Section 32 13 13 Sitework concrete.
- 4. Bury warning tape marked "Caution Sewer Line" 12 inches above all concreteencased piping. Align tape parallel to and within 3 inches of the centerline of the piping.

# B. Power Ducts: Concrete Encased

- 1. Fill: Slurry concrete, 3 inches cover at top, bottom, between conduits and sides of duct bank.
- 2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of duct bank conduit at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving, and less than 12" below finished elevations of interior floor slabs and at building footings where conduit is in the footing structural splay. Slurry per Section 32 13 13 Sitework concrete.
- 3. Install two No. 4 bars in slurry concrete at top of bank under paved areas, minimum 3 inch concrete cover.
- 4. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or to 95 percent under traffic-supporting paved areas.
- 5. Bury warning tape marked "Caution Buried High Voltage Line" 12 inches above all concrete-encased duct banks. Align tape parallel to and within 3 inches of the centerline of the duct bank.

# C. Water Piping and Gas Piping:

- 1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but not less than 4". Minimum thickness above top of piping, 6 inches, compacted to 90 percent.
- 2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of pipes at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving, and less than 12" below finished elevations of interior floor slabs and at building footings where piping is in the footing structural splay. Slurry concrete per Section 32 13 13 Sitework concrete.
- 3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
- 4. Observe joints at pressure tests.
- 5. Bury warning tape marked "Caution Buried Gas (or "Pipeline") Line" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.

## D. Fire Lines:

- 1. Bedding Fill: Manufactured Sand, minimum 6" thickness under piping, minimum thickness above top of piping and sides, 6", compact to 90 percent.
- 2. Fill: Slurry concrete, 6" cover at top pipes at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving. Slurry concrete per Section 32 13 13 Sitework concrete.
- 3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
- 4. Bury warning tape marked "Caution Buried Pipeline" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.
- E. Low Voltage Conduits and Communications: Direct Burial Minimum trench depth 36 inches.
  - 1. Bedding Fill: Sand, 6 inches at bottom, sides and 12 inches on top, compacted to 95 percent.
  - 2. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
  - 3. Bury warning tape marked "Caution Buried Communication Line Below" 12 inches above conduits. Align tape parallel to and within 3 inches of the centerline of conduits.

**END OF SECTION** 



# **SECTION 31 23 19**

### **DEWATERING**

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

A. Section Includes design, acquisition, installation, testing, operation, monitoring and maintenance of open drainage or pre-drainage dewatering system to lower and control ground water levels and hydrostatic pressures, and removal of drainage flow, to permit excavation, backfill and construction to be performed in suitably dry conditions. Control of surface water shall be considered as part of the Work under this specification.

# B. Related Sections

- 1. Section 01 20 00, Price and Payment Procedures
- 2. Section 01 50 00, Temporary Facilities and Controls
- 3. Section 01 57 23, Storm Water Pollution Control
- 4. Section 32 23 16, Excavation
- 5. Section 31 22 00, Earthwork
- 6. Section 33 46 13, Foundation Drainage Systems
- 7. Section 33 23 17, Water Wells
- C. Allowances. Contract Amount paid for work this Section may be adjusted for actual cost of work in accordance with provisions of Division 01 requirements for price and payment procedures.

### 1.02 PERFORMANCE REQUIREMENTS

# A. Dewatering Performance

- Dewatering system shall be of sufficient size and capacity to lower and maintain ground water level at an elevation at least 60-inches below lowest foundation or pipe trench subgrade.
- 2. Dewatering system shall allow soils to be excavated and work conducted in reasonably dry conditions. Soils to be removed shall be sufficiently dry to permit excavation to grades shown and to remain stable without sheeting.
- 3. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, and so that excavation does not flood and to prevent damage to subgrades and permanent structures.
- 4. Maintain stability of sides and bottom of excavations.
- 5. Accomplish dewatering without damage to existing buildings adjacent to excavation.
- 6. Prevent surface water from entering excavations by earth dikes, or other means.

#### 1.03 SUBMITTALS

# A. Action Submittals

1. Product Data for dewatering system components



- 2. Shop Drawings, signed and sealed by installer's engineer, of dewatering system showing arrangement, locations and details of system components including sedimentation containment and means of discharge and disposal of water.
  - Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
  - b. Include a written report of control procedures for use when dewatering problems arise
- 3. Certified Copies of Field Test Reports and computations required for proper design of dewatering system

# B. Record Submittals

- Statement of Qualifications from Installer
- Professional Certification of installer's engineer
- 3. Photo- or video-graphic record of existing conditions adjoining construction and site improvements prior to installation and operation of dewatering system

### C. Closeout Submittals

- 1. Record Documents locating capped utilities and other subsurface structural, electrical, or mechanical conditions performed during dewatering.
  - a. Note locations and capping depth of wells and well points

# 1.04 QUALITY ASSURANCE

- A. Materials submitted shall be in a format acceptable for inclusion in required permit applications, if any, all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching city storm drain systems or regulated bodies of water.
- B. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.
  - 1. Refer to Section 01 57 23, Storm Water Pollution Control.
  - 2. Obtain discharge permits from authorities having jurisdiction.
- C. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Section 01 30 00, Administration Requirements.

# 1.05 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project Site Information: A Geotechnical Report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of Geotechnical Engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by Geotechnical Engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
  - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
  - 2. The Geotechnical Report is referenced elsewhere in the Project Manual.

- C. Survey Work Design Engineer employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
- D. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damaged is evident in adjacent construction.

PART 2 - PRODUCTS

**NOT USED** 

PART 3 - EXECUTION

# 3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
  - Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
  - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

# 3.02 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, discharge lines, sedimentation tanks, and standby power, filter material gradation, valves, appurtenances, water disposal and surface-water controls.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is not longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
  - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.



- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
  - 1. Maintain piezometric water level a minimum of 60 inches below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of Work under construction or completed. Dispose water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks and other flow-control devices as required by authorities having jurisdiction.
  - 1. Refer to Section 01 57 23, Storm Water Pollution Control for additional requirements.
- F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
- G. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- H. Damages: promptly repair damages to adjacent facilities caused by dewatering operations.

### 3.03 OBSERVATION WELLS

- A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and then operate it continuously 24 hours a day, 7 days a week until all utilities and structures have been satisfactorily constructed including placement of backfill materials and dewatering is not longer required.
- B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.
- C. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated Observe and record daily elevation of ground water and piezometric water levels in observation wells.
- D. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
  - 1. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
  - 2. Insure compliance with all conditions of regulating permits and provide such information to the Owner.

# 3.04 CORRECTIVE ACTION



A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundation or structures), perform work necessary for reinstatement of foundation soil resulting from such inadequacy or failure by contractor, at no additional cost to Owner.

**END OF SECTION** 



# **SECTION 31 23 23**

#### **BACKFILLING**

# PART 1 - GENERAL

# 1.01 SECTION INCLUDES

- A. Authorized types of fill.
- B. Building area backfilling to subgrade elevations.

# 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM D1557 Laboratory compaction characteristics of soil using modified effort.
- C. SSPWC Standard Specifications for Public Works Construction, Latest Edition.
- D. Chapters 18A and 33, California Building Code, 2016.
- E. CSS Caltrans Standard Specifications, Latest Edition.

## 1.03 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D 2487 of each [on-site] [and] [borrow] soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site [and] [borrow] soil material proposed for fill and backfill.

B.

#### 1.04 QUALITY ASSURANCE

- A. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - Testing Frequency
    - a. For borrow up to 1,000-cu.yrd, conduct 1 test for each 250-cu.yrds.
    - b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
    - c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.

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- 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
- 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
- 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
- 5. Do not import soils that exhibit a known risk to human health, the environment, or both.

# PART 2 - PRODUCTS

### 2.01 FILL MATERIALS

- A. This Section establishes standards of quality for backfill materials to be used as approved by Geotechnical Engineer in accordance with Chapter 18A CBC, Section 1803A.2 and Appendix J Section J107, California Building Code, and as scheduled in other Sections of this specification.
- B. Crushed Rock and Rock Dust: Crushed rock and rock dust shall be product of crushing rock or gravel. Portion of material that is retained on a 3/8 inch sieve shall contain at least 50 percent of particles having three or more fractured faces. Not over 5 percent shall be pieces that show no such faces resulting from crushing. Of that portion which passes 3/8 inch sieve but is retained on No. 4 sieve, not more than 10 percent shall be gravel particles. Crushed rock shall conform to 3/4 inch sieve size in accordance with Subsection 200-1.2, SSPWC, Crushed Rock Gradation Table.
- C. Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded to the following:

Minimum Size: 1/4 inch.
 Maximum Size: 5/8 inch.

- D. Sand: Sand shall consist of manufactured granular material, or combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for purpose intended. Conform to Section 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.
- E. Crushed Aggregate Base: Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, or Class 2 aggregate base as defined in Section 26, CSS.]
- F. Imported Fill: Clean granular, free of debris, no rock larger than 3 inches in any dimension, non-expansive, approved by Geotechnical Engineer prior to placement on site.
- G. Structural Backfill: Shall conform to SSPWC section 217-3.
- H. Concrete: Structural, as specified in Section 03 30 00.
- I. Concrete Slurry: as specified in Section 31 23 17.

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J. Stockpiled Fill: On-site soils, stored separately on site, approved for re-use by Geotechnical Engineer.

# PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify fill materials to be reused or imported are acceptable to Architect.
- B. Verify foundation perimeter drainage installation has been inspected and approved.

# 3.02 BACKFILLING

- A. Backfill and compact areas to contours and elevations with unfrozen materials. Remove debris from areas to receive backfills.
  - 1. Compaction: ASTM D1557, Compact to 90 percent of maximum dry density.
  - 2. Floor slabs shall be in place a minimum of 7 days before backfill is placed against walls.
- B. Fill areas and types of fill shall be inspected, tested and approved by Geotechnical Engineer.
- C. Employ placement method that does not disturb or damage foundation perimeter drainage, foundation waterproofing and protective cover or utilities in trenches. Do not commence backfill until such work is in place, inspected and approved.
- D. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume work until field tests indicate that moisture content and density of the fill are as previously specified.
- E. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise.
- F. Make grade changes gradual. Blend slope into level areas.
- G. Remove surplus backfill materials from site.
- H. Leave fill material stockpile areas completely free of excess fill materials.
- I. Compaction Equipment: Wherever feasible, perform compaction with approved power-driven equipment such as rollers and sheeps-foot compactors. Compact areas inaccessible to rollers with pneumatic tampers or other approved compactors.
- J. Flooding and jetting is not permitted.

### 3.03 TOLERANCES

- A. Top Surface of Backfilling Subgrade: Within 0.05 feet from required elevations.
- 3.04 FIELD QUALITY CONTROL



- A. No fill shall be placed on any prepared surface until that surface has been inspected and approved by Geotechnical Engineer.
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest. Cost of retests shall be paid by Owner and deducted from contract sum by Change Order.
- C. Frequency of Tests: Geotechnical Engineer may require as many tests as are necessary to ensure specified results.
- 3.05 PROTECTION OF FINISHED WORK
  - A. Protect finished Work.
  - B. Recompact fills subjected to and damaged by vehicular traffic.

# **END OF SECTION**



#### **SECTION 31 23 26**

# STABILIZED SUBSURFACE BASE

### PART 1 - GENERAL

#### 1.01 SCOPE:

- A. This document defines requirements for the materials, installation, and operating performance of an athletic field subsurface base system needed for a professional grade synthetic turf field. Defined are the primary base system requirements for insuring vertical and dimensional stability of the playing surface. Unusual site conditions such as tidal flooding, seismic instability and native soil contamination are outside the scope of this document and require specific analysis and consideration.
- B. All specifications listed are defined per applicable ASTM standard test methods, unless no ASTM standard exists. All other specifications and tolerances listed shall be defined under standard ANSI and/or ISO drawing and specification rules.
  - 1. Concrete curb around the entire perimeter of the athletic field. A composite header (2' x 4') is mounted to the inside face of the concrete curb for synthetic turf attachment.

#### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM D-4829 Standard Test Method for Expansion Index of Soils
- C. ASTM D-2487 Standard Practice for Classification of Soils
- D. ASTM D-5080 Standard Test Method for Determination of (%) Compaction
- E. ASTM D-75 Standard Practice for Sampling Aggregates
- F. ASTM C-136 Standard Test Method for Sieve Analysis of Aggregates

### 1.03 UNDERLYING SOIL REQUIREMENTS

- A. Prior to preparing the sub-base soil, a predetermined amount of material will be excavated from the field area and removed from the site. The amount of soil removal will vary from 3" 6" depending on cross-sectional requirements for crown, slope, backfill, synthetic turf, field events, perimeter curb and drainage elevations.
  - 1. Removals shall conform to testing requirements of Division 01.
- B. The native soil shall be sufficiently irrigated and strafed as required to meet
  - 1. the final conditions set forth below.



C. Field Contour - Overall surface contour after final grading and compaction shall be a lateral or center crown of 0.5% slope minimum. Additional longitudinal crowns at the field ends may be needed to properly dress the entire surface contour to meet minimum slope and nominal header height requirements.

### D. Soils Compaction:

- For non-expansive soils (indices less than 30): After final contouring and rolling, soil compaction shall be greater than 92% on average with no measurement less than 86% based on 8 samples taken at reasonably spaced locations across the field surface. Provide certified test results for soils compaction (ASTM D5080) as required per owner-designated ruling.
- 2. For expansive soils (indices greater than 30): Proper procedures must be followed as recommended per the specific site soils report to achieve a compaction greater than 86% on with no measurement less than 82% among 8 samples.
- E. Finished Soil Contour and Flatness Underlying soil conditions will dictate whether an optional structural base material will be imported and placed prior to installation of the synthetic underlayment material:
  - 1. For installations of base: Local soil contour after final compaction and grading shall not have deviations in surface shape greater than 3/16" over a 10' span. Final contour shall be plotted on a table of laser-sighted grade elevations using a rectangular grid size of 120 yards by 60 yards with measurements every 20 yards (28 total elevation points). Grade elevations to be reviewed and approved prior to installation of the soil isolation fabric.
    - a. The finished compacted and laser-graded surface should be set 1.0" +/-.10" below the top surface of the header in preparation for synthetic underlayment material installation. A graded surface tolerance of +/-1/8" is required along the header with minimal contour deviations allowed.
- 1.04 For installations with (optional) Structural Base: Local soil contour after final compaction and grading shall not have deviations in surface shape greater than 1/2 over a 10 span. Final contour shall be verified using a Óstring line method: lengths of 50-100 pulled taught with high/low spots marked and hand-dressed prior to importation of the structural base material.

### 1.05 SOIL ISOLATION FABRIC

- A. The soil isolation fabric is a nonwoven polypropylene-based material with a minimum gauge weight of four (4) Oz/yd², DuPont SF 65.
- B. The prepared soil subsurface shall be isolated from the synthetic base and turf system above it with a water and air permeable fabric placed across the entire surface of the field. This insures no mixing of the soil subsurface, yet allows water and air passage between the soil and sub-base system. Flow rate of the selected permeable fabric shall be 130 gallons/minute/square foot minimum (ASTM D4491).
- C. Fabric seams within the field of play shall be overlapped a minimum of 8-12" and intermittently bonded or staked into place.
- D. The fabric is additionally draped and formed into the perimeter drainage



- 1. trenches to insure non-penetration of the surrounding soil. The trench fabric
- 2. should be placed in position first with the field fabric placed over it and
- 3. overlapped a minimum of 2 feet prior to pipe and gravel installation.

### 1.06 PERIMETER DRAIN SYSTEM

- A. Surrounding the playing surface and inside the perimeter curbing is located a perimeter drainage system that is coupled to a main drain exit or other equivalent strom drainage overflow system, reference drawings.
- B. The perimeter drainage trench is nominally placed 4–6 feet inboard of the perimeter curbing. The drainage trench should have a width of at least 18 inches to a maximum of 24 inches. Depth of the drainage trench shall be a minimum of 18 inches (at the highest elevation within the system) to 24" maximum depth.
- C. The drainage trench is isolated from the surrounding soil and structural aggregate by use of a polymer fabric as described in Section 4.4 above.
- D. The trench bottoms shall have a drainage slope of 0.5% minimum with a preferred slope of 1% throughout the entire system.
- E. Drainage piping is a perforated 4" 6" [12"] diameter HDPE, refer to drawings.
- F. Drainage piping is encased within the trench in a volume of free-flowing 3/4" minus diameter coarse drain rock compacted to 90% minimum Proctor. Ensure the drain rock contains limited fines so flow of water is not restricted within the system after placement and compaction. A permeability test should be conducted at intervals throughout the trench system to verify performance.
- G. Drainage trenches should be compacted using a localized method resulting in compaction of 90 % minimum with no individual measurement less than 86 %.
- H. Surface contour between the drainage trench and perimeter concrete curb should be counter-sloped to the field at a minimum of 1% for surrounding infiltration (as needed).
- I. Coarse Drainage Rock Gradation Criteria. Refer to Civil Drawings:

Mesh size	% Passing
3/4"	100
5/8	100
1/2"	90-100
3/8"	70-90
#4	25-40
#8	15-30
#30	5-15
#50	0-7
#200	0-3

Local aggregate contour after final compaction and laser grading shall not have deviations in



surface shape greater than 1/4 over a 10 span. Final contour shall be plotted on a table of laser-sighted grade elevations using a rectangular grid size of 120 yards by 60 yards with measurements every 20 yards (28 total elevation points). Grade elevations to be reviewed and approved prior to installation of the synthetic base material.

# 1.07 APPROVALS

- A. Finished Subsurface base work must be approved in advance by the turf manufacturer prior to installation of the synthetic base material. Approvals to be based on documented laser-sighted grade elevations or a physical inspection prior to installation of the soil isolation fabric.
- B. Any approvals sought upon completion without proper documentation or notification will become the responsibility of the General Contractor, as will any costs for repair or refinishing work.

**END OF SECTION** 



#### **SECTION 32 12 16**

## **ASPHALTIC CONCRETE PAVING**

### PART 1 - GENERAL

### 1.01 SUMMARY

- A. Section Includes
  - 1. Asphaltic concrete paving and surface sealer.
  - 2. Sub-base preparation.
  - 3. Aggregate base coarse.
  - 4. Concrete parking bumpers.
  - 5. Asphalt speed bumps.
  - 6. Plastic parking bumpers and speed bumps.
  - 7. Patching and repair of asphaltic concrete paving.
- B. Related Sections
  - 1. Section 01 35 43, Special Environmental Requirements.
  - Section 32 17 23, Pavement Marking.

### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM American Society for Testing and Materials
  - 1. ASTM D977 Standard Specification for Emulsified Asphalt
  - 2. ASTM D1557 Laboratory Compaction Characteristics of Soil Using Modified
  - 3. ASTM D2026 Standard Specification for Cutback Asphalt
- C. AASHTO American Association of State Highways and Transportation Officials
  - 1. AASHTO MP 1 Performance Graded Asphalt Binders
- D. CSS Caltrans Standard Specifications
- E. SCAQMD South Coast Air Quality Management District
  - 1. SCAQMD-1108 SCAQMD Rule 1108, Cutback Asphalt
- F. SSPWC Standard Specifications for Public Works Construction

# 1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with Sections 200, 203 and 302, SSPWC.
- B. Obtain materials from same source throughout, using batch plant method for proportioning and mixing.



#### 1.04 **SUBMITTALS**

- Product data, mix design per Section 01 30 00, Administrative Requirements. Α.
- B. Special Environmental Requirements Form, found in Appendix A of Section 01 35 43 Special Environmental Requirements. Provide the following information for aggregate for base coarse.
  - Recycled Content. 1.
  - Local/Regional Materials. 2.
- C. Special Environmental Requirements Product Form, found in Appendix A of Section 01 35 43 Special Environmental Requirements. Provide the following information for asphalt.
  - 1. Local/Regional Materials.

#### 1.05 **ENVIRONMENTAL REQUIREMENTS**

- Do not place asphalt when base surface temperature is less than 40 degrees F or Α. surface is wet or frozen.
- Conformation to AQMD, Local Regulations. В.

#### 1.06 **SOILS INFORMATION**

A. Geotechnical Investigation has been prepared under direction of Owner. Investigation is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw from information provided. Contract Documents take precedence over recommendations that may be contained in investigation and Contractor must obtain approval for deviations from Contract Documents. Copy of investigation is available at Architect's office.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

Α. Acceptance at site.

# PART 2 - PRODUCTS

#### 2.01 **MATERIALS**

- Asphalt Binder: SSPWC 203-1 or AASHTO MP1. Performance Grade 64-10 South and Α. Central Coast, Inland Valleys Regions, and shall conform to the testing requirements of Table 203-1.2 (A), Section 203 SSPWC.
- Asphalt Aggregate: Uniformly graded in accordance with Section 203-6.2.2, SSPWC. B.



C. Crushed Aggregate Base (CAB): Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, or Class 2 Aggregate Base as defined in Section 26, CSS.

#### 2.02 ACCESSORIES

- A. Primer: ASTM D2026, cutback type, slow curing, Grade SC-250.
- B. Seal Coat: Conform to Section 203-9, SSPWC.
  - 1. GUARDTOP by Industrial Asphalt/Vulcan Material Co., Inc., Irwindale, CA.
  - 2. SATIN SEAL by Blue Diamond Co., Long Beach, CA.
  - 3. Or equal, as approved in accordance with Division 01, General Requirements for Substitutions.

# C. Parking Bumpers:

- 1. Precast concrete type, steel reinforced, air-entrained, 5000 psi, bars No. 3 minimum size. Bars shall extend to within 1-1/2 inches of ends of bumpers. Minimum bumper size: 6-inches high, 8-inches wide, 6-feet long unless otherwise indicated on Drawings. Provide chamfered corners, traverse drainage slots on underside, and a minimum of two factory-formed vertical holes through wheel stop for anchoring to substrate.
- 2. Recycled Plastic Parking Bumpers: 72-inches L x 6-inches W x 4-inches H, including attachment accessories, Model STWHLSTP, color: yellow. By Barco Products Company, Batavia, IL. Or equal.
- 3. Parking Bumpers: "Power-Stop", by Collins and Aikman (510-536-2600 or 800-444-2054), or approved equal meeting the following requirements:
  - Material: 100% recycled composite parking stops manufactured from fibrous reinforcement and a blend of vinyl, nylon fibers, post-consumer plastics, and post-industrial plastics.
  - b. Physical Properties:
    - 1) Density (ASTM D79): 60 lbs/cf.
    - 2) Leaching (EPA 1311): Pass.
    - 3) Water Absorption (ASTM D1027): 0.2%.
    - 4) Nail Pull-Out (ASTM 1761): 170 lbs.
    - 5) Compressive Stress (ASTM D198): 3104 psi.
    - 6) Modulus of Rupture (ASTM D198): 2307 psi.
    - Modulus of Elasticity (ASMT D198): 120731.
  - c. Size: 5-3/4 inches x 3-1/2 inches x length as indicated.
  - d. Provision for Installation: Pre-drill parking stops for two 5/8" diameter rebar anchors.
- 4. Speed bumps: 96-100% post-consumer recycled plastic with countersunk holes for bolts. Provide lag bolts and required hardware. Exposed surfaces shall be dense, smooth, free of pits, honeycomb or other defects.
- 5. Installation adhesives: As recommended by parking stop and speed bump manufacturer for surface to which installed.
- D. Speed Bumps: GNR Technologies, LaSalle, Quebec. Model: "Easy Rider", recycled rubber, 12 inches x 72 inches x 2-1/4 inches with end caps. 3 pieces each location per plans.



- E. Soil Sterilizer: Spike 80DF. Non-selective weed and grass killer, by Dow-Agro Sciences, Indianapolis, IN, EPA Reg. No. 62719-107, or equal, as approved in accordance with Division 01, General Requirements for Substitutions.
  - 1. Active Ingredients:

a. Tebuthiuron: 80%b. Inert Ingredients: 20%c. Total: 100%

- F. Headers: Foundation grade redwood, minimum 2- x 4-inches. Stakes shall be minimum 2- x 3-inches in accordance with Section 302-5.5 SSPWC.
- G. Raised Pavement Markers: Per Section 32 17 23.

### 2.03 ASPHALT PAVING MIX

- A. Use dry material to avoid foaming. Mix Uniformly.
- B. Mix: Surface Coarse; Section 203-6.4 SSPWC, 1/2-inch maximum aggregate size, medium gradation curve, as required by outside temperatures at time of laying.
  - Single Coarse: C2 (Dense Medium) aggregate. Performance Grade 64-10 asphalt.
    - a. Areas where hand spreading is required: Use 3/8-inch mix.
- C. Mix: Section 203-6.4 SSPWC, 3/4-inch asphalt base coarse, 1/2-inch asphalt surface coarse aggregate size.
  - 1. Asphalt Base Coarse: B (Dense Medium Coarse), Performance Grade 64-10 asphalt. Thickness of 2-1/2 inches.
  - 2. Asphalt Surface Coarse: C2 (Dense Medium), Performance Grade 64-10 asphalt. Thickness of 1-1/2 inches.
- D. Recycled Asphalt Concrete (RAC), C2-PG 64-10 RAC: Reclaimed Asphalt Pavement (RAP) maximum 15% unless noted otherwise on drawings, aggregate and asphalt per SSPWC Section 203-7.

### PART 3 - EXECUTION

### 3.01 SUB-GRADE

- A. Bring areas to be surfaced to required subgrades by cutting and filling with suitable equipment.
- B. Scarify subgrade to minimum depth of 6-inches. Bring to optimum moisture content and compact to minimum 90 percent density in accordance with ASTM D1557 by rolling with power roller. Provide hard, even surface to receive subsequent base and paving.
- C. Finish subgrade to required grades with allowance for compression and for thickness of base coarse and finish paving thickness.



# 3.02 SOIL STERILIZATION

- A. After sub-grade has been compacted and approved by Geotechnical Engineer, treat areas to be paved with specified soil sterilizer. Conform to the following:
  - 1. Apply 7.5 lbs. of solution per acre for each 15 gallons of water, spray apply per manufacturer's instructions.
- B. Exercise caution during storage of material and during application. Prevent injury to humans, animal life, adjacent plant life and property. Keep soil sterilization materials minimum three feet from tree wells or any plant life.
- C. Legally dispose of containers.

### 3.03 BASE COARSE

- A. Place and compact aggregate base upon finished subgrade in conformance with Section 301-2 SSPWC. Compaction: 95 percent.
- B. Thickness of Base After Compaction: As indicated on Drawings but not less than 4-inches if indicated.

# 3.04 PREPARATION - PRIMER AND TACK COATS

- A. Apply primer coat on base coarse surfaces in conformance with Section 302-5.3, SSPWC, at rate of 0.10 to 0.25 gallons per sq. yd. Allow to cure prior to application of Asphalt Coarse.
- B. Apply tack coat to contact surfaces of cold joints, curbs, gutters, manholes and adjacent materials, and over existing asphalt surfaces in conformance with Section 302-5.4, SSPWC.
- C. Coat surfaces of catch basin frames with oil to prevent bonding with asphalt pavement. Do not tack coat these surfaces.

# 3.05 PLACING ASPHALT PAVEMENT – SINGLE/DOUBLECOARSE

- A. Install redwood headers.
- B. Place asphalt in conformance with Section 302-5 SSPWC. Conform to temperature maximums and minimums specified therein. Materials shall not be applied which have cooled below lower limit allowable.
  - 1. Install 1/2-inch mix for single coarse asphalt pavement.
  - 2. Install ¾" AC mix for double coarse indicated is section 2.03-C.1 above.
- C. Place to thickness as indicated on drawings but not less than 2 inches if not indicated.
- D. Install drainage grilles and frames in correct position and elevation.



- E. Compact pavement by rolling with equipment specified in Section 302-5.6, SSPWC. Do not displace or extrude pavement from position.
- F. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks, rock pockets, ridges or depressions.
- G. If placing (2) coarses, base coarse may remain untreated until such time as the final coarse is desired near end of construction ctivities.
- H. For second coarse follow steps A through F above using ½ inch AC mix indicated isn section 2.03-C.2 above.

# 3.06 SEAL COAT

- A. Apply seal coat 30 days or more after surface coarse application, in accordance with manufacturer's recommendations.
- B. Apply seal coat to surface coarse in accordance with Section 302-8.2 SSPWC.
- C. Add water to specified seal coat material. When air temperatures of 90 degrees F or more are encountered during application, consult manufacturer for recommendations.
- D. If pavement surface exhibits imperfections noted Placing Asphalt Pavement above, as determined by the Architect, the addition of sand aggregate to seal coat, and amounts thereof, shall be as recommended by the manufacturer.
- E. A second application shall be made after first coat has dried to the touch. When sand is added to the first seal coat, two additional coats without extra sand shall be applied.
- F. Allow seal coat to dry before permitting traffic or striping.

### 3.07 PARKING BUMPERS

- A. Securely attach precast concrete parking bumpers into pavement with two 5/8-inch diameter galvanized solid rod anchors. Extend anchors 24-inches into ground. Apply adhesive to underside of concrete bumpers, as recommended by the manufacturer.
  - Low-VOC emission type, heavy duty adhesives as recommended by the manufacturer or expansion-type steel bolts set in holes drilled into concrete paving.

# 3.08 ASPHALT CONCRETE SPEED BUMPS

- A. Construct hot-mix asphalt speed bumps over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 degrees F (121 degrees C).
- B. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq.yd. (0.2 to 0.7 L/sq.m.).



- C. Asphalt Mix: Same as pavement surface-course mix.
- D. Before installation, mill pavement that will be in contact with bottom of speed bump. Mill to a depth of 1-inch (25mm) from top of pavement to a clean, rough profile.
- E. Place and compact hot-mix asphalt to cross section as indicated on Drawings or as specified below, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.
  - 1. Width: 1'-6", 3" high crown radius to 16".
  - 2. Paint speed bump yellow per Section 32 17 23, Pavement Markings.

# 3.09 SPOT PATCHING AND REPAIRS

- A. Patching: Saw cut perimeter patch and excavate existing pavement section to sound base. Scarify and recompact the upper 12-inches of subgrade to 95% of maximum density. Excavate rectangular or trapezoidal patches, extending 12-inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.
  - 1. Tack coat faces of excavation and allow to cure before paving.
  - 2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
  - 3. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished with adjacent surfaces.

# 3.10 PATCHING AND REPAIR OF ASPHALTIC CONCRETE PAVING

- A. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or portland cement concrete paving to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal.sq.yd. of surface.
  - 1. Allow tack coat to cure undisturbed before paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

# B. Preparation:

- Subgrade Preparation: Scarify earth subgrade to a depth of not less than 6inches, and compact to 95 percent of maximum density.
- 2. Moisten with water to approximate optimum moisture content, and while moist, roll until the surface is unyielding, with a power roller of such weight as to develop a pressure of not less than 200 pounds per linear inch of roller width.
- 3. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.
- 4. Where filling is required, scarify the subgrade to bond the new material to the inplace material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.
- 5. Remove excess material from the site to a legal disposal area.
- C. Compaction Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving coarse over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.



- D. Surface Treatments Slurry Seal: Apply slurry coat in a uniform thickness according to ASTM D3910 and allow to cure.
  - 1. Roll slurry seal to smooth ridges and provide a uniform, smooth surface.

# E. Application General:

- 1. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.
- 2. Compaction expressed in percentages in this section refers to the maximum dry density determined by Test Method No. 2016-F as described in the Caltrans "Manual of Tests".

# F. Application of Base Coarse

- 1. Placing Aggregate Subbase Coarse: Place sub-base coarse on the compacted sub-grade and compact in accordance with CALTRANS "Standard Specifications," Article 25-1.04. Finished surface of the sub-base at any point shall not vary more than 0.08 foot above or below the grade indicated.
- 2. Placing Aggregate Base Coarse: Place base coarse on the compacted aggregate sub-base coarse and compact in accordance with applicable provisions of CALTRANS "Standard Specifications," Sections 25 and 26. Use compacting equipment adequate for the size of the installation and capable of achieving the compaction specified.
- 3. Compact each layer to a relative compaction not less than 95% of that determined by Test Method No. Calif. 216.
- 4. Apply finished base coarse to a thickness which does not vary more than 0.05 foot from the planned thickness at any point. Reshape or rework, water, and thoroughly re-compact base that does not conform to the specified requirements.
- G. Sterilant Application: Place herbicide below asphalt paving. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the paving. Take special care to insure that herbicide is not applied to any areas which are to be planted.

# H. Placing Asphalt Concrete Surface:

- 1. Prime Coat: Before the surface coarse is laid, apply liquid asphalt primer to the base coarse surface at rate of 0.20 to 0.50 gallons per square yard. Apply material to penetrate and seal, but not flood, the surface.
- 2. Paint Binder: Before the surface coarse is laid, paint all vertical surfaces of curbs, gutters, and drainage structures and all cold or existing pavement joints with a paint binder at an approximate rate of 0.05 to 0.10 gallon per square yard.
- 3. Placing Asphaltic Concrete Surface Coarse: Place and compact asphaltic concrete in accordance with Standard Specifications, CALTRANS Section 39-5, 39-6, and 39-7.
- 4. Placing Asphaltic Concrete Surface Coarse: Spread asphaltic concrete mixture at a temperature of not less than 250 degrees F. Place by use of a self-propelled asphalt paving machine, except on small areas where inaccessibility precludes their use. On these small areas spread by means of a spreader box, or by hand methods.



- a. Spread mixture in a single layer (two layers at Contractor's option) to such a thickness that, after receiving the final compaction, the finish paving shall have a minimum thickness as indicated.
- 5. Berms, curbs, and slow down strips shall be placed with an extrusion machine or other equipment capable of shaping and compacting the material to the required cross section.

### Seal Coat:

- Apply to all new asphaltic concrete paving, in accordance with SSPWC Standard Specifications, Section 302-8. Apply to all existing asphaltic concrete paving where indicated, in accordance with SSPWC Standard Specifications, Section 302-8. Dilute emulsion as directed with water not to exceed 20% of the total volume.
- 2. Thoroughly clean foreign matter off pavement before application. No emulsion shall be spread when the atmospheric temperature is less than 60 degrees F., or when weather conditions are unsuitable for drying.
- 3. Apply, just prior to "line" work, at rate of 0.10 gallon per square yard, at temperature between 100 and 140 degrees. If tackiness prevails, lightly dust affected areas with rock dust or fine sand.
- J. Header Board Installation: Install header boards at perimeter of pavement with stakes spaced not over 24 inches on center unless otherwise indicated. Do not install header boards where asphaltic concrete paving abuts buildings, concrete walks or curbs, or other pavements.

# K. Pavement Painting:

- 1. Allow seal coats to cure for ten days before applying paint.
- 2. Cleaning: Sweep and clean surface to eliminate loose material and dust.
- 3. Apply paint with mechanical equipment to produce uniform straight edges. Using painting equipment and templates specifically designed for this purpose. Protect adjoining work from damage.
- 4. Make lines 4" wide unless otherwise indicated.
- 5. Layout markings to exact requirements of Owner. Verify layout line widths, and colors prior to painting.

# L. Field Quality Control:

- 1. Before seal coating, flood the paved areas with water to check drainage and surface irregularities. Replace, or overlay high and low spots in an acceptable manner and water test the paving again after corrections have been made.
- 2. Replace or repair deficient and damaged asphalt paving.
- 3. All paving shall drain properly before being accepted. There shall be no variation greater than 1/4-inch plus or minus from a 10-foot straight edge, except at grade changes.

# 3.11 TOLERANCES

- A. Thickness: Compact each coarse to produce the thickness indicated within the following tolerances:
  - 1. Base Coarse: Plus or minus 1/2-inch.
  - 2. Surface Coarse: Plus 1/4-inch, no minus.



- B. Surface Smoothness: Compact each coarse to produce a surface smoothness within the following tolerances as determined by using a 10-foot straight edge applied transversely or longitudinally to paved areas:
  - Base Coarse: 1/4-inch.
     Surface Coarse: 1/8-inch.
- C. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4-inch.

### 3.12 PROTECTION

A. Protect asphalt paving against vehicular traffic before and for 48 hours following seal coating.

# **END OF SECTION**



# **SECTION 32 12 17**

#### **ASPHALTIC CONCRETE RAMPS**

# PART 1 - GENERAL

### 1.01 SECTION INCLUDES

- A. Asphaltic concrete pedestrian and vehicle ramps.
- B. Sub-base preparation.

# 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM D946 Penetration-Graded Asphalt Cement for Use in Pavement Construction.
- C. ASTM D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. rammer and 18 inch drop.
- D. SSPWC Standard Specifications for Public Works Construction, Latest Edition.
- E. AQMD Air Quality Management District, Local Regulations, Cutback Asphalt.

### 1.03 QUALITY ASSURANCE

- A. Perform work in accordance with Section 203, SSPWC.
- B. Obtain materials from same source throughout, using batch plant method for proportioning and mixing.

### 1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F or surface is wet or frozen.
- B. Conform to AQMD, Local Regulations.

### 1.05 SUBMITTALS

A. Product data.

# PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Asphalt Cement: ASTM D946.
- B. Aggregate: Crushed rock, uniformly graded in accordance with Section 200, SSPWC.



C. Mix: AR4000, Type 1, medium (C) or medium course (B) in accordance with Section 203, SSPWC.

# 2.02 ACCESSORIES

- A. Tack Coat: Homogeneous, slow setting emulsified asphalt SS1H.
- B. Seal Coat: Asphalt based, plant blended, composed of mineral aggregates uniformly distributed in petroleum based asphalt emulsion. Material shall comply with requirements of Section 203 SSPWC, GUARD TOP by Industrial Asphalt, Inc., Irwindale, CA, or equal, as approved in accordance with Division 01, General Requirements for Substitutions.
- C. Soil Sterilizer: Spike 80DF. Non-selective weed and grass killer, by Dow-AgroSciences, Indianapolis, IN, EPA Reg. No. 62719-107, or equal, as approved in accordance with Division 01, General Requirements for Substitutions.
  - 1. Active Ingredients:

a. Tebuthiuron 80 percent
b. Inert Ingredients 20 percent

Total 100 Percent

### PART 3 - EXECUTION

# 3.01 SUB-BASE

- A. Bring areas to be surfaced to required subgrades by cutting and filling with suitable equipment.
- B. Scarify subgrade to a minimum depth of 6 inches. Bring to optimum moisture content and compact to minimum 90 percent density in accordance with ASTM D1557 by rolling with a power roller. Provide a hard, even surface to receive paving.
- C. Finish subgrade to required grades with allowance for compression and for thickness of finish paving thickness.

# 3.02 SOIL STERILIZATION

- A. After sub-base has been compacted and approved by Geotechnical Engineer, treat areas to be paved with specified soil sterilizer. Conform to following:
  - 1. Apply 7.5 lbs. of solution per acre for each 15 gallons of water, spray apply per manufacturer's instructions.
- B. Exercise caution during storage of material and during application. Prevent injury to humans, animal life, adjacent plant life and property. Keep soil sterilization materials minimum three feet from tree wells or any plant life.
- C. Legally dispose containers.

# **HMC** Architects

### 3.03 PREPARATION - TACK COAT

- A. Apply soil sterilizer at ramps over grade, omit sterilizer at ramps over existing asphalt paving.
- B. Apply tack coat over existing asphalt surfaces in conformance with Section 302, SSPWC.

### 3.04 PLACING ASPHALT

- A. Provide wood headers in conformance with Section 302, SSPWC.
- B. Place asphalt in conformance with Section 302, SSPWC.
- C. Place to thickness of minimum 3 inches or to profile required for ramp configuration.
- D. Compact pavement by rolling with equipment specified in Section 302, SSPWC. Do not displace or extrude pavement from position.
- E. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### 3.05 SEAL COAT

- A. Apply seal coat 28 days or more after surface course application or as recommended by the seal coat manufacturer. Verify timing with construction schedule.
- B. Add water to specified seal coat material in amounts approved by the manufacturer, to conform to the air temperatures encountered during application.
- C. Apply seal coat to surface course in accordance with Section 302, SSPWC.
- D. A second application shall be made after first coat has dried to the touch.
- E. Allow seal coat to dry before permitting traffic, striping or installation of railings.

# 3.06 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From True Elevation: Within 1/2 inch.

# 3.07 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury.

### **END OF SECTION**



# **SECTION 32 12 43**

#### STABILIZED DECOMPOSED GRANITE PAVING

### PART 1 - GENERAL

#### 1.01 SCOPE

- Α. This Section includes material and labor requirements for construction with decomposed granite paving with Stabilizer binder additive for the following items:
  - 1. Stabilized decomposed granite pathway

#### 1.02 PERFORMANCE REQUIREMENTS

Α. Perform gradation of decomposed granite material in accordance with ASTM C 136 -Method for Sieve Analysis for Fine and Course.

#### 1.03 **SUBMITTALS**

Products Data: For each product specified. Submit a 5 lb. sample and sieve analysis Α. for grading of decomposed granite to be sent to Stabilizer Solutions, Inc. prior to any construction – (allow 2 week turn around). Must be approved by Landscape Architect and owner.

#### 1.04 PROJECT/SITE CONDITIONS

- Field Measurements: Each bidder is required to visit the site of the Work to verify the Α. existing conditions. No adjustments will be made to the Contract Sum for variations in the existing conditions.
  - Where surfacing is indicated to fit with other construction, verify dimensions of 1. other construction by field measurements before proceeding with the work.
- B. Environmental Limitations: Do not install decomposed granite paving during rainy conditions or below 40 degrees Fahrenheit and falling.

#### 1.05 QUALITY ASSURANCE

Α. Installer Qualifications: Installer to provide evidence to indicate successful experience in providing decomposed granite or crushed 3/8" or 1/4" minus aggregate paving containing Stabilizer binder additive.



#### 1.06 WARRANTY

- Α. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the installer agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
  - 1. Premature wear and tear, provide the material is maintained in accordance with manufacturer's written maintenance instructions.
  - 2. Failure of system to meet performance requirements.
- Warranty Period: Contractor shall provide warranty for performance of product. C. Contractor shall warranty installation of product for the time of one year from completion.
- Contractor shall provide, for a period of sixty days, unconditional maintenance and D. repairs as required.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- Α. Stabilizer for decomposed granite and crushed stone surfaces provided by the following manufacturer:
  - Stabilizer Solutions, Inc. 205 South 28<sup>th</sup> St., Phoenix, AZ 85034; phone (602) 1. 225-5900, (800) 336-2468; fax (602) 225-5902; website stabilizersolutions.com; email lphubbs@stabilizersolutions.com



#### 2.02 **MATERIALS**

- Α. **Decomposed Granite screenings** 
  - 1. Crushed Stone Sieve Analysis Percentage of Weight Passing a Square Mesh Sieve AASHTO T11-82 and T27-82

1/4" MINUS AGGREGATE GRADATION

U.S. Sieve No.	Percent Passing by Weight
# 3/8"	100
# 4	90 – 100
#8	75 – 80
# 16	55 – 65
# 30	40 – 50
# 50	25 – 35
# 100	15 – 20
# 200 to	10 – 15

#### B. Stabilized Binder

1. Patented, non-toxic, organic binder that is a colorless and odorless concentrated powder that binds decomposed granite or crushed 3/8" or 1/4" minus aggregate

# PART 3 - EXECUTION

#### 3.01 **BLENDING STABILIZER**

Α. Mechanically blend 12 to 16 lbs (call manufacturer for exact blend) of Stabilizer per 1ton of decomposed granite. It is critical that Stabilizer be thoroughly and uniformly mixed throughout decomposed granite. Bucket blending is not acceptable. Blending with a rake and or shovel is not acceptable.

#### 3.02 **PLACEMENT**

- After pre-blending, place the Stabilized decomposed aggregate on prepared sub-Α. grade. Level to desired grade and cross section.
- Depth of pathways -3" for heavy foot traffic and light vehicles. B.



#### 3.03 WATERING

Α. Water heavily to achieve full depth moisture penetration of the Stabilized pathway Profile. Water activates Stabilizer. To achieve saturation of Stabilized pathway Profile, 25 to 45 gallons of water per 1-ton must be applied. During water application randomly test for depth using a probing device to the final depth.

#### 3.04 COMPACTION

- Α. Upon thorough moisture penetration, compact aggregate screenings to 85% relative compaction by compaction equipment such as; a 2 to 4-ton double drum roller or a 1,000 lb. Single drum roller with vibratory plate tamp. Do not begin compaction for 6 hours after placement and up to 48 hours.
- B. Take care in compacting decomposed granite when adjacent to planting and irrigation systems. Hand tamping with 8" or 10" hand tamp recommended.

#### 3.05 **INSPECTION**

Finished surface of pathway shall be smooth, uniform and solid. There shall be no Α. evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material shall not be present on the surface. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

#### 3.06 MAINTENANCE

- Remove debris, such as paper, grass clippings, leaves or other organic material by Α. mechanically blowing or hand raking the surface as needed.
- B. During the first year, a minor amount of loose aggregate will appear on the paving surface (1/16" to 1/4"). If this material exceeds a 1/4", redistribute the material over the entire surface. Water thoroughly to the depth of 1". Compact with power roller of no less than 1000 lbs. This process should be repeated as needed.
- If cracking occurs, simply sweep fines into the cracks, water thoroughly and hand tamp C. with an 8" - 10" hand tamp plate.



#### 3.07 **REPAIRS**

- Excavate damaged area to the depth of the Stabilized aggregate and square off Α. sidewalls.
- B. If area is dry, moisten damaged portion lightly.
- C. Pre-bend the dry required amount of Stabilizer powder with the proper amount of aggregate in a concrete mixer.
- Add water to the pre-blended aggregate and Stabilizer. Thoroughly moisten mix with D. 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.
- E. Apply moistened pre-blended aggregate to excavated area to finish grade.
- F. Compact with an 8" to 10" hand tamp or 250 to 300 pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

**END OF SECTION** 



#### **SECTION 32 13 13**

### SITEWORK CONCRETE

### PART 1 - GENERAL

#### 1.01 SUMMARY

### A. Section Includes

- 1. Cast-In-Place concrete pedestrian paving and sidewalks.
- 2. Curbs and gutters.
- 3. Concrete stairs, ramps and landings.
- 4. Light standard bases, fence post bases flagpole bases monument sign railing footings and similar site structures.
- 5. Utility concrete pads.
- 6. Perimeter concrete curbing, mow strips, concrete drainage structures, swales.

#### B. Related Sections:

- 1. Section 01 35 43, Special Environmental Requirements.
- 2. Section 31 23 16 Excavation.
- 3. Section 32 14 13, Unit Pavers, Detectable Warnings (Truncated Domes) texture.
- 4. Section 32 17 26 Tactile/Detectable Warning Surface Tile

# 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
- C. ACI 224.3R-95 Joints in Concrete Construction
- D. ACI 318-14 Building Code Requirements for Structural Concrete and Commentary, 2008 Edition.
- E. ACI 301 Structural Concrete for Buildings.
- F. ASTM American Society for Testing and Materials
  - 1. ASTM A185 Steel Welded Wire Reinforcement, Plain, for Concrete
  - 2. ASTM A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - 3. ASTM C33 Concrete Aggregates
  - 4. ASTM C94 Ready-Mixed Concrete
  - 5. ASTM C150 Portland Cement
  - 6. ASTM C171 Sheet Materials for Curing Concrete
  - 7. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete
  - 8. ASTM C618 Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as a Mineral Admixture on Concrete
  - 9. ASTM C920 Elastomeric Joint Sealants
  - 10. ASTM C979 Pigments for Integrally Colored Concrete
  - 11. ASTM C1107 Packaged Dry, Hydraulic Cement Grout (Non-Shrink)



- 12. ASTM D1751 Preformed Expansion Joint Fillers for Concrete, Paving and Structural Construction
- 13. ASTM E1980-11 Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- G. CBC 2016 California Building Code and Supplements
  - 1. CBC-11 CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
  - 2. CBC-17 CBC Chapter 17A, Structural Tests and Special Inspections
  - 3. CBC-19 CBC Chapter 19A, Concrete DSA
- H. LEED-NC Reference Guide.

### 1.03 SUBMITTALS

- A. Placement Schedule for approval: Provide details or sketches showing location of each placement of concrete Work only if there is a deviation from the approved plan. Do not deviate from location of expansion joints or scorelines as indicated on the Architectural plans.
- B. Design mix for each concrete mix if devieating from regional standards.
- C. Steel reinforcement shop drawings, including materials, grade, bar schedules, spacing, bent bar diagrams, arrangement and supports if deveating from approved plans.
- D. Submit contraction (crack control) joint, expansion, isolation and construction joint layout to Architect for approval if requested.
- E. Product data on joint filler, sealants, curing compounds and reinforcing if requested.
- F. Project Record Documents
  - 1. Accurately record actual locations of embedded sleeves, utilities and components that are concealed from view.
- G. Sustainable Design Submittals: Provide the following information by filling out the Special Environmental Requirements Product Submittal Form located in Appendix A of Section 01 35 43 Special Environmental Requirements, together with required supporting documentation.
  - 1. Recycled Materials
  - Local/Regional Materials.

# 1.04 REGULATORY REQUIREMENTS

- A. Pedestrian walks, plazas and paving shall comply with CBC Chapter 11B. Portland Cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.
- B. Solar Reflectivity Index (SRI) of Concrete: minimum SRI of 35 target values per LEED-NC Reference Guide for LEED. LEED Sustainable Sites Credit 7.1.



# 1.05 QUALITY ASSURANCE

- A. Maintain one copy of all records on site.
- B. Acquire cement and aggregate from same source for all Work.
- C. Conform to ACI 318-14 Chapter 5.13, California Building Code, when placing concrete during hot weather.
- D. Conform to ACI 318-14 Chapter 5.12, California Building Code, when placing concrete during cold weather. No placement of concrete permitted below 50 degrees Fahrenheit.
- E. Mock-up Only required for concrete finishes OTHER than standard
  - Install minimum 5 feet by 5 feet mock-up of concrete sidewalk for each surface treatment specified.
  - 2. Install mock-up one month prior to installation.
  - 3. Locate as approved by the Architect.
  - 4. Use identical forming system, sub-grade type, reinforcing, expansion joints, score joints, finishing and edge trim as specified for installation.
  - 5. Architect approval required.
  - 6. Mock-up may not be used in final installation.
  - 7. Remove mock-up materials from site and dispose legally.

# PART 2 - PRODUCTS

# 2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150 Type I Normal or Type II Moderate, Portland Cement type, from one manufacturing plant only.
- B. Aggregates: ASTM C33, single source for all materials. Maximum size aggregate: 1 inch.
- C. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 7,500 psi in 7 days unless otherwise indicated on Drawings; of consistency suitable for application and a 30 minute working time.
- D. Threshold and landing mortar: Wheelchair lift ramp mortar: Ardex ERM Exterior Ramp Mortar, Mapei Quickcem Top 101 or equal. Finish with manufacturer's cement dressing products for smooth surface.
- E. Crushed Aggregate Base: As specified in Section 32 12 16. Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, , or Class 2 aggregate base as defined in Section 26, CSS.

# 2.02 ACCESSORIES

A. Expansion Joints:



- 1. Expansion Joint Filler ASTM D1751: Closed cell, 1/2 inch thick; DECK-O-FOAM by W. R. Meadows, Dayton Superior or equal.
- 2. Joint Devices: Integral extruded polystyrene plastic; 1/2 inch max. thick, with removable top strip exposing sealant trough; Snap Cap Expansion Joint Cap by W. R. Meadows or equal.
- 3. Sealant: Polyurethane two-component type, self-leveling, for level surface application, UREXPAN NR-200 or DYNATRED for sloped surfaces, manufactured by Pecora Corp., Harleysville PA, or equal. Color shall be selected by Architect from manufacturer's standard list of colors.
- 4. Primer: As recommended by sealant manufacturer.
- 5. Joint Backing: ASTM C1330, Cylindrical, Type C, closed cell, polyethylene backer rod; oversized 30 to 50 percent larger than joint width. Green Rod by Nomaco Inc. or equal.
- B. Highway Fiber Expansion Joint: 1/2 inch max. thick; FIBER EXPANSION JOINT by American Highway Technology, Kankakee, IL, or equal.
- C. Slip Resistant Finish: Dry shake type White aluminum oxide abrasive grains, hardness No. 9 on Mohr's scale; Emery Non-slip, manufactured by Dayton Superior, Kansas City, KS, Emery Aggregate manufactured by Oregon Emery Co., Halsey OR, or equal as approved in accordance with Division 01, General Requirements for Substitutions.
- D. Safety Stair Nosings: Style B-41A, 4 inches wide manufactured by Barrycraft Pattern and Foundry, Inc., Birmingham, AL, or equal as approved in accordance with Division 01, General Requirements for Substitutions. Provide nosings (strips) at all treads.
  - 1. Install 2" wide nosings (Strips) (2" min. 4" max.) in contrasting color (70% contrasting), 1" maximum from edge of nosing of each exterior stairs, CBC Section 11B-504.4.1. Colors to be selected by Architect.
  - Install in fresh concrete, cast in place.Renovation Treads: comply with CBC 11B-247.2 and 11B-705.2. Aluminum, anti-slip tread 9/32 inches thick, 11 inches wide, Model Type 511 SN two tone by Wooster Products Inc., Wooster, Ohio. comply with CBC 11B-504.2. Aluminum, anti-slip tread Model Type SG4702-5 inch tread SG500R-9 inch tread by American Safety Tread Co., Helena AL, or equal.
  - 3. Install 2 inches contrasting color (70 percent recommended) warning stripe 1 inch maximum from edge of nosing of each exterior stair, and top and bottom nosing only at interior stairs.
  - 4. Install at existing exterior concrete stairs with manufacturer's adhesive and countersunk screws.

#### 2.03 CONCRETE MIX

- A. Mix and deliver concrete in accordance with Section 1905A, California Building Code. Deliver concrete in transit mixers only. Mix concrete for 10 minutes minimum at a peripheral drum speed of approximately 200 feet per minute. Mix at jobsite minimum 3 minutes. Discharge loads in less than 1-1/2 hours or under 300 revolutions of the drum, whichever comes first, after water is first added.
  - Design Mix:
    - a. Conform to ACI 318-14 Chapter 5.8 for Proportioning on the basis if field experience or trial mixtures method.



- b. Conform to ACI 318-14 Chapter 5.8 for Selection of concrete proportions method. Selection of concrete proportions and ingredients for design mix by a DSA -approved Testing Laboratory and certified by a registered civil engineer licensed in California.
- 2. Do not exceed 0.50 water-cement ratio by weight for slabs and for other concrete.
- 3. Quantities of Materials: Weighmaster's records not required for sitework concrete.
- 4. Required Strength: Minimum 3,000 psi for sitework concrete.
- B. Fly ash shall be used at 15% maximum replacement of the Portland cement at a 1:1 replacement ratio by weight. Fly Ash shall meet the requirements of ASTM C 618 with the exception that the Loss on Ignition shall not exceed 1.0 percent. Only Class F material is permitted.
- C. Solar Reflectivity Index (SRI) of Concrete: provide concrete mix that yields a minimum SRI of 35 with Solar Reflectance value of 0.35 and emittance of 0.9.
- D. Slurry Concrete:
  - 1. Slump: Between 4 inches and 6 inches.
  - 2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
  - 3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).
  - 4. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.

# 2.04 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; deformed billet steel bars, in grades as follows, and conforming to CBC-19, Section 1903A.
  - 1. For No. 4 and larger bars, use 60 ksi yield grade.
  - 2. For ties and stirrups, and No. 3 and smaller bars, use 40 ksi yield grade.
  - 3. For welded bars, use ASTM A706 60 ksi yield grade.
- B. Welded Wire Reinforcement: Plain type, ASTM A185; in flat sheets; uncoated finish, 6 x 6 W4.0 x W4.0 unless otherwise note on drawings.
- C. Tie Wire: Annealed steel, minimum 16 gage size.
- D. Dowels: ASTM A615; 60 ksi yield grade, plain steel, uncoated finish.
- E. Secondary Reinforcement (plastic shrinkage control) Fibrous Reinforcement: Fibrillated, polypropylene fibers for concrete slabs with length of 3/4", Grace Fibers by W.R. Grace, or polypropylene monofilament fibers of 3/4" length Grace Mircofibers by the W.R. Grace, or equal. Meeting requirements of ASTM C1116, Type III.
  - 1. Dosage: 1.0 lbs per cubic yard of concrete for 3/4" long fibers.

# 2.05 FORMS

A. Conform to ACI 318-14 Chapter 6.



- B. Plywood Forms: APA Medium density overlay, Group 1, Exterior, PS-1, for exposed surfaces. APA Plyform B-B, Class 1, Exterior, PS-1 for unexposed surfaces.
  - 1. Use flexible or curved forms for curves with a radius 100 feet or less.
- C. Lumber: Douglas Fir species, construction grade, Surfaced Lumber, with grade stamp clearly visible for smooth and straight exposed surface.
- D. Form Release Agent; commercially formulated form-release agent that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

# 2.06 CURING MATERIALS

- A. Polyethylene Film ASTM C171; 10 mil thick, clear, manufactured from virgin resin with no scrap or additives, manufactured by Burke-Edoco, Long Beach, CA, or equal as approved in accordance with Division 01, General Requirements for Substitutions.
- B. Water: Potable and not detrimental to concrete.
- C. Curing Compound for Non-Colored, Exposed Concrete or Concrete to be Covered: Water-based, non-staining compound that will not affect the appearance of the concrete, nor adversely affect the bond or effectiveness of subsequent treatments to be applied to the concrete surface. Curing compound to be applied to concrete surfaces that are to receive subsequent coatings or treatments, such as paint, waterproofing, flooring materials, sealers, etc. shall be specially formulated for such use and shall be certified by the manufacturer not to inhibit the bonding qualities of the treatments. When tested in accordance with ASTM C-156, compound shall restrict the loss of water to not more than 0.62 kg per square meter. Acceptable Product, Atlas Quantum-Cure, by Atlas Tech Products, or approved equal.

# PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify site conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely and will not cause hardship in placing concrete.

# 3.02 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is doweled to existing Work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.



- 1. Remove existing natural soils to depth required for sitework concrete thickness and elevations.
- 2. Remove unsuitable soil, backfill with clean compactable soil or approve granular material to required elevations.
- 3. Scarify exposed natural sub-base to depth of 6 inches. Bring to optimum moisture content and re-compact to 90 percent in accordance with ASTM D 1557.
- Add approved aggregated base to required elevation in 6 inch maximum lifts. Bring to optimum moisture content and compact to 90 percent in accordance with ASTM D1557.

# 3.03 PLACING CONCRETE (GENERAL)

- A. Convey and deposit concrete in accordance with ACI 318-14 Chapter 5.9 and 5.10. Remove loose dirt from excavations.
- B. Notify Job Inspector minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and accessories are not disturbed during concrete placement.
- D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.
- E. Place concrete continuously between predetermined expansion joints.
  - 1. Install expansion joints at vertical concrete walls at 24 feet on center unless noted otherwise on drawings.
- F. Do not interrupt successive placement; do not permit cold joints to occur. Avoid segregation of materials. Perform tamping and vibrating so as to produce a dense, smooth application free of rock pockets and voids. Do not use vibrators to move concrete horizontally.
- G. Do not allow concrete to fall free from any height which will cause materials to segregate. Maximum height of free fall permitted in any case: 5 feet.
- H. Defective Installation: Repair and clean at Contractor's expense all concrete damaged or discolored during construction. Where concrete requires repair before acceptance, the repair shall be made by removing and replacing entire section between joints and not by refinishing the damaged portion.
- I. Proper curing of concrete surfaces is the responsibility of the Contractor. Concrete failing to meet specified strength shall be removed and replaced.

### 3.04 ON-SITE CONCRETE SIDEWALKS, PEDESTRIAN PAVED AREAS AND RAMPS

- A. Forms, Wood: Free from warp, with smooth and straight upper edges, surfaced one side, minimum thickness 1-1/2 inches adequate to resist springing or deflection from placing concrete.
- B. Forms, Metal: Gauge thickness sufficient to provide rigidity and strength equivalent to wood.



- C. Reinforcing Steel: #4 bars, place bars at 12 inches on center each way for sidewalks and paved areas and #4 bars for edges unless otherwise indicated on Drawings.
- D. Reinforcement: Provide welded steel wire fabric, 6 inches by 6 inches, No. 10 gage at middle of slab for sidewalks and ramps. Interrupt reinforcement at expansion joints.
- E. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete for entire length of pour. Strike off upper surface to specified grades.
- F. Isolation Joints: Locate at slabs abutting vertical concrete surfaces and as patterned on drawings. Install vertically, full depth of concrete with preformed joint filler recessed for plastic cap at 1/2 inch depth at top for sealant application.
  - Doweled Isolation Joints at Heavy Vehicle Driveways and Parking: At abutting building foundations; provide 1/2-inch diameter smooth steel dowels 14 inches long, one end of dowel lubricated and set in capped sleeve to allow for longitudinal movement, spaced at 24 inches on center maximum, 6 inches from edges.
  - 2. Monolithic Curb and Gutter: No expansion joints required between gutter and curb face.
- G. Expansion Joints: Locate maximum 24 feet centers and as patterned on drawings. Install vertically full depth of concrete, install preformed joint filler recessed for plastic cap at 1/2 inch depth at top for sealant application. \*\*\*\*\*dowels are not necessary unless heavy trucks will use surface. Aggregate interlock provide sufficient load transfer for normal sitework concrete.\*\*\*\*\*
  - Monolithic Curb and Gutter: No expansion joints required between gutter and curb face.
- H. Contraction/Crack Control Joints: At 8 feet each way at concrete paved areas, and 5 feet at sidewalks, tool joint with 1/2 inch radius, depth 1/4 the thickness of slab but not less than 1 inch deep. Refer to drawings for required design patterns.
- I. Curb Ramps: Form grooves, flush to finished surfaces, 12" wide border. Grooves at 1/4" deep, 1/4" wide and at 3/4" on centers at 3 sides on level surface of the sidewalk. Provide patterns as indicated in drawings. Detectable Warnings at Curb Ramps per IR 11B-2 and 11B-3, 11B-4 CBC 11B-705.1.1 and 11B-705.1.2.2
  - 1. Detectable warning (Truncated Domes) required at curb ramps less than 1:15 (6.7% slope), DSA IR 11B-3
  - 2. Detectable Warnings (Truncated Domes) required at all Curb Ramps, American with Disabilities Act Standards for Accessibility Design Section 4.7.7.
    - a. Set Paver Truncated Dome products in full mortar bed per Section 32 14 13 Unit Pavers and as indicated on drawings.
    - b. Plastics/Composites: Cast in place plastic tiles per manufacturer's instructions and in accordance with CBC.
    - c. Form bottom edge flush and free of abrupt changes.
- J. Finish:
  - 1. Portland cement paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.



- 2. Screed concrete to required grade, float to a smooth, flat, uniform surface. Edge all headers to 1/2 inch radius. Edge expansion joints to 1/4 inch radius. Steel trowel to hard surface.
- 3. Medium Broom Finish: After final troweling, apply a medium broom finish transverse to centerline or direction of traffic.
- K. Curing: Cure surfaces utilizing one of the following methods:
  - 1. Spraying: Spray water over slab areas and maintain wet for 7 days.
  - 2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
  - 3. Apply liquid curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units of any kind.
- L. Remove expansion joint plastic caps. Prime both sides of joint and apply self-leveling sealant per Section 07 92 00. Provide smooth concave surface.
- 3.05 LIGHT STANDARD BASES, FENCE POST BASES, FLAGPOLE BASES, RAILING FOOTINGS, MISCELLANUOUS SURFACES, UTILITY PADS, AND SIMILAR SITE STRUCTURES
  - A. Forms: Suitable material and type, size, shape, quality and strength to insure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.
  - B. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale loose or thick rust and coatings.
  - C. Coordinate installation of conduits, cast in place items and other inserts.
  - D. Finish: Grind or sack as required as determined by the Architect to produce a smooth, straight, plumb and acceptable finish without burrs or form marks. For horizontal surfaces: provide float finish.
  - E. Curing: Cure surfaces utilizing one of the following methods:
    - 1. Spraying: Spray water over slab areas and maintain wet for 7 days.
    - 2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
    - 3. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units or finish of any kind.
  - F. Flagpole bases: refer to Section 10 75 00, Flagpoles for size of footings and cast in place items supplied by that section.



# 3.06 CONCRETE MONUMENT SIGNS

- A. Verify concrete footings have been installed per details and shop drawings.
- B. Prefabricated Monument Sign: Architect designed custom monument sign as indicated on drawings.
- C. Reinforcement: Place accurately and hold in position, spacers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of oil, dirt, loose mill scale, loose or thick rust and coatings.
- D. Forms: Plywood, APA medium density overlay, group I, exterior, PS-1 for sign surface. Ensure forms are set level and firm.
- E. Letter Forms: Exterior grade polystyrene, minimum 1 inch deep, edges sloped at approximately 15 degrees, smooth flat face, firmly attached to plywood form, reverse image by VEFO Inc., Walnut, CA, or equal.
- F. Coordinate with this Section to prevent formation of rock pockets or voids on surfaces.
- G. Coordinate forms removal. Edges and corners of recessed surfaces shall be clean, sharp, and unbroken.

# H. Finish:

- 1. Entire sign assembly shall be sandblasted lightly to remove laitance. Surfaces shall be uniformly textured.
- 2. Smooth-Rubbed Finish or Sack-rubbed finish as determined by the Architect to produce a straight, plumb and textured finish without burrs or form marks. For horizontal surfaces: provide float finish.
- I. Curing: Cure surfaces utilizing one of the following methods:
  - 1. Spread polyethylene film over areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; protect film from damage and dislodging, maintain in place for 7 days.
  - 2. Apply liquid curing compound-clear at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive masonry units.

### 3.07 FORMED CONCRETE STAIRS AND LANDINGS

- A. Subgrade Preparation: As approved by the Geotechnical Engineer.
- B. Forms: Suitable material and type, size, shape, quality and strength to ensure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.
- C. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale, loose or thick rust and coatings.



- D. Install specified metal safety nosings flush to finished surfaces.
- E. Finish: Hard steel trowel at monolithic risers. Steel trowel surfaces treated with Slip Resistant Finish sufficiently to allow particles to extend slightly above finish surface.
  - 1. Slip Resistant Finish: Apply in accordance with manufacturer's instructions on surfaces at a minimum rate of 50 lbs. per 100 square feet.
  - 2. Owner's Option in lieu of Slip Resistant Finish:
    - a. Apply Medium Broom Finish.
- F. Curing: Cure surfaces utilizing one of the following methods:
  - 1. Spraying: Spray water over slab areas and maintain wet for 7 days.
  - 2. Contractor's Option
    - Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
    - b. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator.
- 3.08 CURB AND GUTTER, MOW STRIPS CONCRETE DRAINAGE STRUCTURES SWALES
  - A. Subgrade Preparation: Subgrade material, base material and compaction requirements as approved by the Geotechnical Engineer.
  - B. Forms: Single face type required, cut to conform exactly with face batter and radius, sufficiently rigid to resist springing or deflection from concrete placement. Clean forms of all loose dirt, mortar or similar materials and apply a light coating of oil or other suitable material prior to concrete placement.
    - 1. Slip Forms: Contractor's option upon approval of the Architect.
  - C. Reinforcement: Refer to drawings for size and spacing. Interrupt reinforcement at expansion joints.
  - D. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete to entire length of pour. Strike off upper surface to specified grades. Cut drain pipes to conform to curb batter.
  - E. Expansion Joints: Locate joint filler at maximum 20 foot centers. Trim off excess filler material flush to finish surface. No sealant application required.
  - F. Control Joints: at 8 feet on center, tooled joints, 1/2 inch radius.
  - G. Finish: Apply thin layer of mortar of 1 part portland cement to 1-1/2 parts sand to exposed faces. Trowel to a smooth and even finish with a fine hair broom applied parallel with the line of the work. Round all edges to 1/2 inch radius. No Contractor identification permitted.
  - H. Curing: Cure surfaces utilizing one of the following methods:
    - 1. Spraying: Spray water over curb and gutter and maintain wet for 7 days.



- 2. Spread polyethylene film over areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
- 3. Apply liquid-curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator.

# 3.09 FINISH AT EXPOSED VERTICAL SURFACES

- A. Rubbed Finish: Apply the following to smooth-formed finished concrete per ACI 301:
  - 1. Grout-Cleaned Finish (Sack-rubbed finish): Remove fins, rough spots, stains, and hardened mortar by carefully rubbing with a fine abrasive stone to a smooth even surface. Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces.
  - 2. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  - 3. 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.
  - 4. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface with slow-speed grinder. In a swirling motion, finish surface with a cork float.

# 3.10 BUILD-UP CONCRETE AT DOOR TRESHOLDS FOR ACCESSIBLITY COMPLIANCE

- A. Remove concrete areas as indicated on drawings.
- B. Install Threshold and Landing Mortar at front of doors, 72 x 60 inches, level area, and edges to ramp to a maximum slope of 5%.

### 3.11 WHEELCHAIR-LIFT CONCRETE RAMP

A. Install wheelchair-lift concrete ramp and landing at location in front of wheelchair lift, 48 x 50 inches area flush to lift platform, ramp to landing shall have a slope of 8.3% and side flares at 12.5%. Outline pit area with contrasting paint color, 2" line, per Section 09 90 00 Painting.

# 3.12 FIELD QUALITY CONTROL

A. Provide free access to Work and cooperate with testing personnel



B. Measure Solar Reflectivity values of Site concrete and submit reports to Architect. ASTM E1980-11

# 3.13 TOLERANCES

- A. Construction tolerances shall not violate dimensions, grades, slopes required by CBC for accessibility requirements. Adjust work accordingly to comply with requirements.
- B. Comply with tolerances of ACI 117 and as follows (tolerances may not exceed CBC maximum or minimum):
  - 1. Maximum deviation of 1/8 inch in 10 feet.
  - 2. Elevation: 1/4 inch (6 mm).
  - 3. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
  - 4. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/8 inch (3 mm).
  - 5. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
  - 6. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
  - 7. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
  - 8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
  - 9. Joint Spacing: 3 inches (75 mm).
  - 10. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
  - 11. Joint Width: Plus 1/8 inch (3 mm), no minus.



# **SECTION 32 13 13**

### **CONCRETE WALKS**

### PART I: GENERAL

#### 1.01 SCOPE

A. This Section includes placing concrete for walks at locations shown on the Drawings.

# 1.02 QUALITY ASSURANCE

- B. All construction shall be in conformance with Local and State codes. Contractor shall be responsible for obtaining all required permits.
- C. Protect adjacent work and materials. Remove all rubbish and accumulated materials and leave work in clean, orderly and acceptable condition.
- D. Obtain the pertinent engineering and or architectural plans before commencing work.
- E. Contractor shall provide safety barricades and flashers and required by local codes.

### 1.03 MODIFICATIONS AND SAMPLES AND SUBMITTALS

A. Design modifications may be made only as necessary to meet field conditions and to insure the correct alignment and relationship of the work, and only as directed by the Landscape Architect.

# PART 2: PRODUCTS

#### 2.01 MATERIALS

- A. Concrete and the equipment, workmanship, and materials, including all sampling and testing shall be in accordance with applicable requirements of Section 303-5. of the Standard Specifications for Public Works Construction. (2013 Edition).
- B. All concrete for site flatwork shall be 2,500 PSI minimum strength at 30 days with 3" slump range.
- C. The forms shall conform to the applicable requirements of Section 303-5.2 of the Standard Specifications for Public Works Construction. (2013 Edition)
- Use coarse aggregate conforming to the requirements for coarse aggregate as specified in the Standard Specifications for Public Works Construction. (2013 Edition)
- E. Reinforcing bars shall be deformed steel bars, conforming with ASTM A 615, grade 40.

### PART 3: EXECUTION



#### 3.01 PREPARATION

A. The subgrade shall be constructed true to grade and to the cross section shown on the Drawings. The subgrade shall be compacted to a density of 95 percent (minimum).

### 3.02 INSTALLATION

- A. Deposit concrete in forms on compacted subgrade.
- B. Provide and install 3/8" wide preformed expansion joint material in concrete walks and curbs at intervals as specified on the Plans, at intersections of concrete walks, and at intersections with other concrete surfaces, building foundations and other fixed surfaces. Expansion joints are to be recessed 1/2" below the top of the finished pavement surface and shall have tear-off plastic caps to allow for the installation of elastomeric sealant.
- C. Provide and install 1/4" wide preformed expansion joint material around all appurtenances such as manholes, inlets, utility poles, etc. that fall within the limits of Portland cement concrete pavement, sidewalk.
- D. Level concrete off and tamp sufficiently to bring mortar to the surface. Finish off with a wood float afterward.
- E. After floating walks, round edges with an approved edger. Score concrete walks transverely at intervals not exceeding width of walk or as shown on the Drawings.

### 3.03 FINISHING

- A. Finish the final finishes of concrete for walks, ramps, and steps after floating. Finishes are as noted on the plans.
- B. Broom Finish: Pull broom across freshly floated concrete to produce fine texture in straight lines perpendicular to main line of traffic. Do not dampen brooms.

### 3.04 CURING

A. Protect and cure finished concrete paving, complying with applicable requirements of the Standard Specifications (Green Book). Use membrane forming curing compound or approved moist curing methods per manufacturer's requirements. Follow manufacturer's written instructions for colored concrete.

# 3.05 TOLERANCES

A. Minor variations in appearance of colored concrete, which are similar to natural variations in color and appearance of unpigmented concrete, are acceptable.



# 3.06 SEALANTS AND CLEAN-UP

- A. Furnish and install elastomeric expansion joint sealant in all 3/8" wide expansion joints. Color of sealant is to match finished concrete color. Spread clean silica sand on freshly filled joint sealant.
- B. Repair or replace broken or defective concrete as directed by the Landscape Architect.
- C. Protect concrete surfaces from damage until acceptance of the work. Exclude traffic from pavements for at least 14 days after placement.
- D. Sweep concrete pavement and wash free of stains, discolorations, dirt or other foreign material prior to acceptance.



# **SECTION 32 13 14**

#### PORTLAND CEMENT CONCRETE PAVING

# PART 1 - GENERAL

### 1.01 SECTION INCLUDES

- A. Concrete paving for loading area and areas designated for heavy traffic, including fire lanes.
- B. Related Sections:
  - 1. Section 01 35 43, Special Environmental Requirements.

### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- C. ASTM C33 Concrete Aggregates.
- D. ASTM C94 Ready-Mixed Concrete.
- E. ASTM C150 Portland Cement.
- F. ASTM C171 Specification for Sheet Materials for Curing Concrete.
- G. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete.
- H. ASTM C1107 Packaged Dry, Hydraulic Cement Grout (Non-Shrink).
- I. ASTM D1751 Preformed Expansion Joint Fillers for Concrete, Paving and Structural Construction.
- J. ASTM D1557- 02 Laboratory compaction characteristics of soil using modified effort.
- K. Chapter 19A, California Building Code, 2016.
- L. ASTM C618 Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as a Mineral Admixture on Concrete.

# 1.03 SUBMITTALS

- A. Placement Schedule providing details or sketches showing location of each proposed placement. Do not deviate from location of expansion joints or scorelines as indicated on Architectural drawings.
- B. Data on joint filler, sealants, curing compounds and reinforcing.



- C. Special Environmental Requirements Submittal Product Form, found in Appendix A of Section 01 35 43 Special Environmental Requirements. Provide the following information for concrete materials and steel reinforcement:
  - 1. Recycled Content.
  - 2. Local/Regional Materials.

### 1.04 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of embedded sleeves, utilities and components which are concealed from view.

# 1.05 QUALITY ASSURANCE

- A. Maintain one copy of all records on site.
- B. Acquire cement and aggregate from same source for all work.
- C. Conform to Section 5.13 ACI 318-14, when concreting during hot weather.
- D. Conform to Section 5.12 ACI 318-14, when concreting during cold weather. No pouring permitted below 40 degrees Fahrenheit.

# PART 2 - PRODUCTS

# 2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150 Type I Normal or Type II Moderate, Portland Cement Type, one manufacturing plant only.
- B. Aggregates: ASTM C33, Single Source for all materials.
- C. Non-Shrink Grout: ASTM C1107 Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 7 days; of consistency suitable for application and a 30 minute working time.
- D. Fly ash shall be used at 15% maximum replacement of the Portland cement at a 1:1 replacement ratio by weight. Fly Ash shall meet the requirements of ASTM C 618 with the exception that the Loss on Ignition shall not exceed 1.0 percent. Only Class F material is permitted.
- E. Crushed Aggregate Base: As specified in Section 32 12 16. Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 aggregate base as defined in Section 26, CSS.

# 2.02 ACCESSORIES

A. Expansion Joint Filler - ASTM D1751: Close cell bituminous saturated fiberboard, 1/2 inch thick; FIBER EXPANSION JOINT manufactured by American Highway Technology, Kankakee, IL, or approved equal.



- B. Construction Joint Devices: Integral extruded polystyrene plastic; 1/2 inch thick, with removable top strip exposing sealant trough; JOINT CAPS.
- C. Sealant: Polyurethane two-component type, self leveling, for level surface application, UREXPAN NE-200, manufactured by the Pecora Corp., Harleysville PA, or equal as approved in accordance with Division 01 for Substitutions.
- D. Primer: As recommended by Sealant Manufacturer.
- E. Slip Resistant Finish: Dry shake type aluminum oxide abrasive grains, hardness No. 9 on Mohr's scale; Emery Non-slip, manufactured by Dayton Superior, Kansas City, KS, Emery Aggregate manufactured by Oregon Emery Co., Halsey OR, or equal as approved in accordance with Division 01, General Requirements for Substitutions.

# 2.03 CONCRETE MIX

- A. Mix and deliver concrete in accordance with Section 5.3 ACI 318-14. Deliver concrete in transit mixers only. Mix concrete for 10 minutes minimum at a peripheral drum speed of approximately 200 feet per minute. Mix at jobsite minimum 3 minutes. Discharge loads in less than 1-1/2 hours or under 300 revolutions of the drum, whichever comes first, after water is first added.
  - 1. Design Mix: Conform to Method B or C, Section 5.3 ACI 318-14.
  - 2. Quantities of Materials: Weighmaster's records not required for sitework concrete.
  - 3. Required Strength: Minimum 4,000 psi, for paving concrete, minimum 7 inches thick.

### 2.04 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; 60 ksi yield grade, deformed billet steel bars, uncoated finish.
- B. Tie Wire: Annealed steel, minimum 16 gage size.
- C. Dowels: ASTM A615; 40 ksi yield grade, plain steel, uncoated finish.

### 2.05 CURING MATERIALS

- A. Polyethylene Film ASTM C171; 10 mil thick, clear, manufactured from virgin resin with no scrap or additives, manufactured by Burke By Edoco, Long Beach, CA, or equal as approved in accordance with Division 01, General Requirements for Substitutions.
- B. Water: Potable and not detrimental to concrete.
- C. Curing Compound: ASTM C309; wax resin base, WHITE PIGMENTED CURING COMPOUND, by Burke By Edoco, Long Beach, CA, or equal as approved in accordance with Division 01, General Requirements for Substitutions. Curing materials and procedures for colored concrete in accordance with coloring material manufacturer's recommendations.



### PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify site conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely and will not cause hardship in placing concrete.

# 3.02 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

# 3.03 PLACING CONCRETE (GENERAL)

- A. Place concrete in accordance with Section 3.7 ACI 318-14. Remove loose dirt from excavations.
- B. Notify Job Inspector minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and accessories are not disturbed during concrete placement.
- D. Ensure sub-base or base materials have been compacted or otherwise treated as required by the Geotechnical Engineer, minimum 12 inches of compacted subgrade to 95 percent per ASTM D1557.
- E. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.
- F. Place concrete continuously between predetermined expansion joints.
- G. Do not interrupt successive placement; do not permit cold joints to occur. Avoid segregation of materials. Perform tamping and vibrating so as to produce a dense, smooth application free of rock pockets and voids. Do not use vibrators to move concrete horizontally.
- H. Do not allow concrete to fall free from any height which will cause materials to segregate. Maximum height of free fall permitted in any case: 5 feet.
- I. Defective Installation: Repair and clean at Contractor's expense all concrete damaged or discolored during construction. Where concrete requires repair before acceptance, the repair shall be made by removing and replacing entire section between joints and not by refinishing the damaged portion.



J. Proper curing of concrete surfaces is the responsibility of the Contractor. Concrete failing to meet specified strength shall be removed and replaced.

# 3.04 CONCRETE PAVING

- A. Forms, Wood: Free from warp, with smooth and straight upper edges, surfaced one side, minimum thickness 1-1/2 inches adequate to resist springing or deflection from placing concrete.
- B. Forms, Metal: Gauge sufficient to provide equivalent rigidity and strength.
- C. Reinforcement: Unless indicated otherwise on the drawings, provide #4 rebar at 18 inches on center each way. Interrupt reinforcement at expansion joints.
- D. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete for entire length of pour. Strike off upper surface to specified grades.
- E. Isolation Joints: Locate where slabs join vertical concrete surfaces. Install vertically, full depth of concrete leaving plastic cap at 1/2 inch depth at top for sealant application.
  - Doweled Isolation Joints at Heavy Vehicle Driveways and Parking: At abutting building foundations; provide 1/2-inch diameter smooth steel dowels 14 inches long, one end of dowel lubricated and set in capped sleeve to allow for longitudinal movement, spaced at 24 inches on center maximum, 6 inches from edges.
- F. Expansion Joint: Locate maximum 20 feet centers and as patterned on drawings. Install vertically, full depth of concrete, install preformed filler leaving plastic cap at 1/2 inch depth at top for sealant application.
  - Doweled Expansion Joints at Heavy Vehicle, Fire Lanes, Driveways and Parking Lots: Provide 1/2 inch diameter smooth steel dowels, 14 inches long at expansion joints with one end of dowel lubricated and set in capped sleeve to allow for longitudinal movement. Spacing: 24 inches on center maximum, 6 inches from edges.
- G. Contraction/Control Joints: Smooth trowel joints and edges at 8 feet each way at concrete paved areas, and 5 feet at sidewalks. Tool joint with 1/2 inch radius, depth, one fourth the thickness of slab but not less than 1 inch deep. Curved or non-aligned joints not acceptable. See drawings for design patterns.

### H. Finish:

- 1. Steel Trowel: Screed concrete to required grade, float to a smooth, flat, uniform surface. Edge all headers to 1/2 inch radius. Edge expansion joints to 1/8 inch radius. Steel trowel to hard, smooth surface.
  - a. Grades less than 6 percent: After final troweling, apply a fine hard broom finish transverse to centerline.
  - b. Grades exceeding 6 percent: Hand finish with wood float, and apply a dry shake type aluminum oxide non-slip surface treatment in accordance with manufacturer's recommendations. Remark as necessary after final finish to assure neat uniform edges, joints and score lines.



- c. Score Lines: Minimum depth 1/4 inch and radius 1/8 inch, located at maximum 5 foot squares.
- 2. Broom Finish
  - a. Medium: Surfaces less than 6 percent.
  - b. Heavy: Surfaces greater than 6 percent.
- I. Curing: Cure surfaces utilizing one of the following methods:
  - 1. Spraying: Spray water over slab areas and maintain wet for 7 days use burlap mats.
  - 2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
  - 3. Apply liquid curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units or finish of any kind.

### 3.05 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
  - Maximum deviation of 1/8 inch in 10 feet.
  - 2. Elevation: 1/4 inch (6 mm).
  - 3. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
  - 4. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/8 (3 mm).
  - 5. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
  - 6. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
  - 7. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
  - 8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
  - 9. Joint Spacing: 3 inches (75 mm).
  - 10. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
  - 11. Joint Width: Plus 1/8 inch (3 mm), no minus.



# **SECTION 32 13 14.10**

#### PERVIOUS CONCRETE PAVEMENT

### PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes sub-grade, sub-base preparation installation and installation of Portland Cement Previous Pavement for sidewalks, courtyards and parking areas.

### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM American Society for Testing and Materials
  - 1. ASTM C29, Test for Unit Weight and Voids in Aggregate
  - 2. ASTM C33, Specification for Concrete Aggregates
  - 3. ASTM C150, Specifications for Portland Cement (Types I and II only)
  - 4. ASTM C260, Specification for Air-Entraining Admixtures for Concrete
  - 5. ASTM C494, Specification for Chemical Admixtures for Concrete
  - 6. ASTM C595, Specification for Blended Hydraulic Cements (Types IP or IS only)
  - 7. ASTM C618, Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
  - 8. ASTM D1557, Tests for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10 Pound Rammer and 18-inch Drop
- C. NRMCA The National Ready Mixed Concrete Association

### 1.03 SUBMITTALS

# A. Action Submittal

- 1. Mix Design: Furnish proposed mix design with proportions of materials to Architect prior to commencement of work including, integral coloring. Cement content: minimum of 580-pounds per cubic yard of Portland Cement, total cementitious content: minimum of 630-pounds per cubic yard. Water-Cement ratio: maximum of 0.30. Based on the unit weight of the mix, compacted void content of the mix shall be a minimum of 10-percent and a maximum of 20percent.
- 2. Test Panels: Prepare test panels. Cost of creating and removing such panels shall be covered in the contract. Test panels shall be of the same thickness and on the same sub-base as the project slab.
- 3. Test panels shall be tested for thickness in accordance with ASTM C 42 and thickness of the slab shall measure no less than 1/4-inch of the design.
- 4. Unit weights are shall be determined in accordance with ASTM C 29 using a 0.25 cubic-foot cylindrical metal measure. The measure is shall be filled and



compacted in accordance with ASTM C29 paragraph 11, jigging procedure. Based on the unit weight of the mix compacted void content of the mix shall be a minimum of 10-percent and a maximum of 20-percent.

### B. Information Submittal

Provide installer's NRMCA Certification.

# C. Closeout Submittal

1. Furnish architect a statement attesting to qualifications, experience, sample of workmanship and installed product.

### 1.04 QUALITY ASSURANCE

- A. Installer(s): an authorized or licensed installation/service agent for manufacturer with minimum 3 years' experience installing Pervious Concrete Pavement for commercial projects similar in scale and complexity to those required in this Project.
- B. Minimum (1) Certified Qualified installer(s) by the National Ready Mixed Concrete Association shall be employed by the contractor.

### PART 2 - PRODUCTS

# 2.01 MATERIALS

- A. General: locally available materials having a record of satisfactory performance.
- B. Cement: Portland Cement Type I or II conforming to ASTM C150 or Portland Cement Type IP or IS conforming to ASTM C595.
- C. Aggregates: 3/8 coarse aggregate that meets 3/8 to No. 16 per ASTM C33, or meeting 3/8 to No. 50 per ASTM D448, smooth (rounded) rock aggregate.

### D. Chemical Admixtures

- 1. Air entraining agents shall comply with ASTM C260
- 2. Type A Water Reducing Admixtures shall comply with ASTM C494
- 3. Type B Retarding Admixtures shall comply with ASTM C494
- 4. Type D Water Reducing/Retarding Admixtures shall comply with ASTM C494
- 5. Hydration stabilizer shall meet the requirements of ASTM C494 Type B. Retarding Admixtures or Type D Water Reducing/Retarding Admixtures.

# E. Mineral Admixtures

- 1. Fly ash conforming to ASTM C618 may be used in amounts not to exceed 20percent of total cementitious material.
- F. Sub-base aggregate: #57 stone, with a 20-percent to 40-percent void factor.
- G. Geotextile Fabric. To protect against fines migrating up into the aggregate base.



- H. Water: potable water
- I. Proportions. pavement subject to vehicular traffic loading, the total cementitious content shall not be less than 630-pounds per cubic yard. Portland Cement content shall be at least 580-pounds per cubic yard.
- J. Water Cement Ratio: Maximum of 0.30, compressive strength of 3250 psi.
- K. Aggregate Content. The volume of aggregate per cubic yard equal to 27 cubic-feet when calculated as a function of the unit weight determined in accordance with ASTM C29 jigging procedure. Fine aggregate, if used, shall not exceed 3 cu. ft. and shall be included in the total aggregate volume.
- L. Admixtures: used in accordance with the manufacturer's instructions and recommendations including integral colors. Colors shall be selected by Architect.
- M. Mix Water. Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate.

# PART 3 - EXECUTION

# 3.01 SUB-GRADE PREPARATION AND FORM-WORK

- A. Sub-grade Material: The top 8-inches shall be composed of granular or gravel soil predominantly sandy with no more than moderate amount of silt or clay. Granular sub-base may be placed over the sub-grade.
- B. Sub-grade Permeability: Sub-grade shall have a reasonable level of permeability.
- C. Sub-grade Support:
  - 1. Scarified to a depth of 12-inch and compacted by a mechanical vibratory compactor to 92 to 95-percent of a maximum dry density as established by ASTM D1557. Sub-grade stabilization shall not be permitted.
  - 2. If fill material is required to bring the sub-grade to final elevation, it shall be clean and free of deleterious materials. Place in 8-inch maximum layers, and compacted by a mechanical vibratory compactor to a minimum density of 92-percent of a dry density as established by ASTM D1557.



- D. Sub-grade Moisture. Subgrade shall be in a moist condition.
- E. Install geotextile material over subgrade, overlap 6-inches.
- F. Install sub-base to8-inch thickness, compact to 90-percent, ASTM D1557.
- G. Formwork: Forms may be of wood or steel and shall be the depth of the pavement. Forms shall be sufficient strength and stability to support mechanical equipment without deformation of plan profiles following spreading, strike-off and compaction operations. Forms shall have a removable spacer of 1/2- to 5/8-inch thickness placed above the depth of pavement. The spacers are removed following placement and vibratory strike-off to allow roller compaction. Forms shall allow for tie-in to adjacent concrete via the use of fiberglass reinforced plastic (RFP) reinforcing bar.
  - Thickness of Pervious Concrete: 8-inches.
- H. Mixing, Hauling and Placing
  - 1. Mix Time. Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.
  - 2. Transportation: Transported or mixed on site and shall be used within one (1) hour of the introduction of mix water, unless otherwise approved by an engineer. This time can be increased to 90 minutes when utilizing a hydration stabilizer as specified.
  - 3. Discharge. Each mixer will be inspected for appearance of concrete uniformity. Water may be added to obtain the required mix consistency. A minimum of 20 revolutions at the manufacturer's designated mixing speed shall be required following the addition of any water to the mix. Discharge shall be a continuous operation and shall be completed as quickly as possible. Concrete shall be deposited as close to its final position as practicable and such that fresh concrete enters the mass of previously placed concrete.
  - 4. Placing and Finishing the pervious concrete pavement will be placed to the required cross-section and shall not deviate more than ±3/8-inch in 10-feet from profile grade.
    - b. Unless otherwise approved by the Architect, provide either slip form or form riding equipment to place the concrete. Normal placement procedures involve utilizing a mechanical vibratory screed to strike off the concrete 1/2to 5/8-inch above final height, utilizing the form spacers described in section.
    - c. Following strike-off, the spacers are removed, to form level, utilizing a steel roller made from nominal 10-inch diameter steel pipe of 1/4-inch thickness. The roller shall have enough weight to provide a minimum of 10 psi vertical force.
    - d. Upon strike-off, use compactive roller to provide a minimum of 10 psi vertical force in order to secure the surface materials and assure durability. The pervious concrete pavement will be placed to the required cross-section and not deviate more than ±3/8-inch in 10-feet from profile grade.
    - e. Surface shall be immediately cured.
  - 5. Curing. Keeping the surface moist is critical to strength gain. Curing procedures shall begin immediately after and no longer than 20 minutes after final placement operations. The pavement surface shall be covered with a minimum of 6-mil thick polyethylene sheet or other approved covering material. Prior to covering, a fog



or light mist shall be sprayed above the surface when required due to ambient conditions. The cover shall overlap exposed edges and shall be secured to prevent dislocation due to winds or adjacent traffic conditions.

- a. Cure times:
  - 1) Portland Cement Type I, II or IS 7 days minimum
  - 2) Portland Cement Type I or II with Class F Fly ash or Type IP 10 days minimum.
- b. No truck traffic shall be allowed for 10 days (no passenger car/light trucks for 7 days.
- 6. Jointing
  - a. Control (contraction) joints, installed at regular intervals not to exceed 20 feet, or two times the width of the placement and as indicated on drawings.
  - b. The control joints shall be installed at 1/4 the depth (to a maximum depth of 1-1/2-inch) of the thickness of the pavement.
  - c. Joints formed in the plastic concrete.
- 7. Transverse Construction Joints
  - a. Transverse construction joints shall be installed whenever placing is suspended for a sufficient length of time that concrete may begin to harden. In order to assure aggregate bond at construction joints, a bonding agent suitable for bonding fresh concrete to existing concrete shall be brushed, rolled or sprayed on existing pavement surface edge. Isolation (expansion) joints will not be used except when pavement is abutting slabs or other adjoining structures.
- 8. Testing and Acceptance
  - a. A minimum of one test for each day's placement of pervious concrete in accordance with ASTM C172 and ASTM C 29 to verify unit weight shall be conducted. Delivered unit weights are shall be determined in accordance with ASTM C 29 using a 0.25 cubic-foot cylindrical metal measure. The measure is shall be filled and compacted in accordance with ASTM C29 paragraph 11, jigging procedure. The unit weight of the delivered concrete shall be +/-5 pcf of the design unit weight. Based on the unit weight of the mix, compacted void content of the mix shall be a minimum of 10-percent and a maximum of 20-percent.



#### **SECTION 32 14 13**

### PRECAST UNIT PAVERS

# PART 1 - GENERAL

# 1.01 SECTION INCLUDES

- A. Concrete paver units.
- B. Bedding and joint sand.
- C. Clean gravel water storage base
- D. Liner and geotextile underliners

#### 1.2 REFERENCES

- A. American Society of Testing and Materials (ASTM):
  - 1. C 33, Specification for Concrete Aggregates.
  - 2. C 136, Method for Sieve Analysis for Fine and Coarse Aggregate.
  - 3. C 140, Sampling and Testing Concrete Masonry Units.
  - 4. C 144, Standard Specification for Aggregate for Masonry Mortar.
  - 5. C 936, Specification for Solid Interlocking Concrete Paving Units.
  - 6. C 979, Specification for Pigments for Integrally Colored Concrete.
  - 7. D 698, Test Methods for Moisture Density Relations of Soil and Soil Aggregate mixtures using a 5.5-lb (2.49 kg) Rammer and 12 in. (305 mm) drop.
  - 8. D 1557, Test Methods for Moisture Density Relations of Soil and Soil Aggregate mixtures using a 10-lb (4.54 kg) Rammer and 18 in. (457 mm) drop.
  - 9. D 2940, Graded Aggregate Material for Bases or Subbases for Highways or Airports

# 1.3 QUALITY ASSURANCE

- A. Installation shall be by a contractor and crew with at least two years of experience in placing interlocking concrete pavers on projects of similar nature or dollar cost within 100 miles of the project site.
- B. Contractor shall conform to all local and state licensing and bonding requirements.

# 1.4 SUBMITTALS

- A. Product data for paving products, liners or geotextiles other than those specifically specified on the drawings.
- B. Full size samples of concrete paving units to indicate color and shape selections. Color will be selected by the Landscape Architect from manufacturer's standard available colors.
- C. Sieve analysis for grading of bedding and joint stabilizer.
- D. Sieve analysis for grading of gravel storage base.
- E. Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 or other applicable requirements.



# 1.5 MOCK-UPS

- A. Install a 5 ft. x 5 ft. (minimum size) paver area as described in Article 3.2.
- B. This area will be used to determine surcharge of the bedding layer, joint sizes, lines, laying pattern(s), color(s), and texture of the job.
- C. This area shall be the standard from which the work will be judged and shall be incorporated into the work.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver concrete pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by fork lift or clamp lift. Unload pavers at job site in such a manner that no damage occurs to the product.
- B. Cover sand with waterproof covering to prevent exposure to rainfall or removal by wind. Secure the covering in place.
- C. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.

### 1.7 ENVIRONMENTAL CONDITIONS

- A. Do not install bedding or pavers during heavy rain or snowfall.
- B. Do not install pavers over muddy bedding.

### PART 2 – PRODUCTS

### 2.1 CONCRETE PAVERS

- A. Product manufacturer, name(s)/shape(s), color(s), overall dimensions, and thickness shall be as specified on the plans, or District approved equal.
- B. Meet the following requirements set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units:
  - 1. Average compressive strength of 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa).
  - 2. Average absorption of 5% with no unit greater than 7% when tested in accordance with ASTM C 140.
  - 3. Resistance to 50 freeze-thaw cycles when tested according to ASTM C 67.
  - 4. Dimensions: Dimensions of paving slabs, and concave or convex warping shall not differ from those agreed upon by the manufacturer by more than the following amounts:
    - a. Length and width: 1.0 mm to + 2.0 mm
    - b. Height: + 3.0 mm
- C. Concave or convex warping in one dimension by the following amounts:
  - 1. Up to 450 mm, 2.0 mm; or, Over 450 mm, 3.0 mm



### 2.2 BEDDING AGGREGATE AND BEDDING SAND

- A. Clean, non-plastic, free from deleterious or foreign matter; manufactured from natural or crushed rock. Do not use limestone or soft stone with a micro-devial degradation of over 8 percent. The percentage of angular and sub-angular particles shall be greater than 90%. Do not use rounded river gravel. When concrete pavers are subject to vehicular traffic, the bedding shall be as hard as practically available.
- B. Bedding sand shall conform to the grading requirements of as shown in Table 1. Table 1

Grading Requirements for Bedding Sand			
ASTM C 33			
Sieve Size	Percent Passing		
3/8 in. (9.5 mm)	100		
No. 4 (4.75 mm)	95 to 100		
No. 8 (2.36 mm)	85 to 100		
No. 16 (1.18 mm)	50 to 85		
No. 30 (0.600 mm)	25 to 60		
No. 50 (0.300 mm)	10 to 30		
No. 100 (0.150 mm)	2 to 10		

C. Bedding aggregate for use under pavers shall conform to the grading requirements of as shown in Table 1A.

Table 1A

Table 171		
Grading Requirements for Bedding Aggregate		
Course		
ASTM C 33		
Sieve Size Percent Passing		
3/8 in. (9.5 mm)	85-100	
No. 4 (4.75 mm)	10 to 30	
No. 8 (2.36 mm)	0 to 10	
No. 16 (1.18 mm)	0 to 5	

# 2.3 EDGE RESTRAINTS

A. Edge restraints shall be concrete as shown on the plans.

### 2.4 NON-WOVEN FILTER FABRIC

A. Non-woven filter fabric for use under the bedding course of vehicular pavements shall be DuPont Spunbond 5401WF (16.2 mil) non-woven, or equal.

# 2.5 JOINT STABILIZER COMPOUND

A. Joint stabilizer shall be 3 mm sieve size crushed granite sand.



# PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade preparation, compacted density and elevations conform to the specifications. Soil subgrade shall be compacted to at least 95% Standard Proctor Density per ASTM D 698. Verify that base is dry, uniform, even, and ready to support sand, pavers, and imposed loads.
- B. Verify location, type, installation and elevations of edge restraints around the perimeter area to be paved.
  - 1. Beginning the work of gravel base, bedding sand and paver installation means acceptance of base and edge restraints.

### 3.2 BASE INSTALLATION

- A. Place liners and/or geotextiles according to specifications and drawings.
- B. Place and compact aggregate base materials to the thicknesses, compaction, surface tolerances, and elevations conforming to these specifications. Do not wrinkle or fold geotextile or liners.
  - 1. Spread and compact aggregate base in uniform layers Base surface tolerance shall be plus or minus 3/8 in. (10 mm) over a 10 ft. (3 m) straight edge.
  - 2. Compact base with 10 ton vibratory roller. Conduct 2 passes minimum in vibratory mode and 2 minimum in static mode until there is no visible movement of the base.
  - 3. Compact bedding with vibratory plate until there is no visible movement of the bedding material.
  - 4. Use mechanical tampers for compaction of soil subgrade and aggregate base around lamp standards, utility structures, building edges, curbs, tree wells and other protrusions.

### 3.3 PAVER INSTALLATION

- A. Spread the bedding evenly over the base course and filter fabric. Screed bedding to required thicknesses and grades. The screeded bedding should not be disturbed. Place sufficient bedding to stay ahead of the laid pavers. Do not use the bedding to fill depressions in the base surface.
- B. Ensure that pavers are free of foreign material before installation.
- C. Lay the pavers in the pattern(s) as shown on the drawings. Maintain straight pattern lines.
- D. Joints between the pavers on average shall be as recommended by the manufacturer for the specific paver type.



- E. Fill gaps at the edges of the paved area with cut pavers or edge units. Units along edged subject to vehicular traffic shall be cut to no smaller than one-third of a whole paver.
- F. Cut pavers to be placed along edges with a masonry saw.
- G. Use a low amplitude, high frequency plate vibrator to vibrate the pavers into the bedding. Use 75-90 Hz compactor capable of a minimum of 5200 pounds of centrifugal compaction force.
- H. Vibrate the pavers, sweeping dry joint compound into the joints and vibrating until they are full. This will require at least two or three passes with the vibrator. Do not vibrate within 3 ft. (1 m) of the unrestrained edges of the paving units.
- I. All work to within 3 ft. (1 m) of the laying face must be left fully compacted with sand-filled joints at the end of each day.
- J. Sweep off excess sand when the job is complete.
- K. The final surface elevations shall not deviate more than 3/8 in. (10 mm) under a 10 ft. (3 m) long straightedge.
- L. The surface elevation of pavers shall be 1/8" ± above adjacent drainage inlets, concrete collars or channels. For installation on a compacted aggregate base and soil subgrade, the top surface of the pavers may be 1/8"± above the final elevations after compaction. This difference in initial and final elevation is to compensate for possible minor settling

### 3.4 FIELD QUALITY CONTROL

- A. After removal of excess sand, check final elevations for conformance to the drawings.
- B. All paver installations are to be guaranteed against settling or heaving of more than ¼" over the first winter after the completion of installation. Areas that heave more than ¼", are damaged by snow plowing operations due to heaving or settling, or settle more than ¼" are to be replaced by the contractor, including any required reinstallation of base materials, recompaction and re-setting of pavers, at no additional cost to the District.

### **SECTION 32 17 23**

### **PAVEMENT MARKINGS**

# PART 1 - GENERAL

### 1.01 SUMMARY

- A. Section Includes
  - 1. Traffic markings including symbols, directional arrows, lettering and safety and loading zones
  - 2. Parking-stall lines and related accessibility pavement markings
  - 3. Pedestrian and related accessibility pavement markings
  - 4. Fire lane markings
  - 5. Raised pavement markers
- B. Related Sections
  - 1. Section 01 35 42, CALGreen Requirements
  - 2. Section 32 12 16, Asphaltic Concrete Paving
  - 3. Section 32 13 13, Sitework Concrete

### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ADA Americans with Disabilities Act of 1990, as amended
  - ADA Standards Current addition
- C. APCD Air Pollution Control District of San Diego County
  - 1. APCD-67.0 APCD Regulation IV, Rule 67.0, Architectural Coatings
  - 2. APCD-67.21 APCD Regulation IV, Rule 67.21, Adhesive Material Application Operations
- D. ASTM American Society for Testing and Materials
  - 1. ASTM C 881 Epoxy-Resin-Base Bonding Systems for Concrete
  - 2. ASTM D 788 Classification System for Poly(Methyl Methacrylate) (PMMA) Molding and Extrusion Compounds
  - 3. BAAQMD-8.3 BAAQMD Regulation 8, Rule 3, Architectural Coatings
  - 4. BAAQMD-8.51 BAAQMD Regulation 8, Rule 51, Adhesive and Sealant Products
- E. CALTrans California Department of Transportation
  - 1. CALTrans Manual CALTrans, Manual for Uniform Traffic Control Devices
  - 2. CALTrans Specifications CALTrans, Standard Specifications
- F. CBC 2016 California Building Code (CCR Title 24, Part 2)
  - CBC-11B CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing

- G. California Green Building Standards Code, CALGreen 2016.
- H. Fed.Std / Fed.Spec Federal Standard / Federal Specification
  - 1. Fed.Std-595C Colors Listed in Government Procurement
  - 2. Fed.Spec TT-P-1952D Paint, Traffic and Airfield Marking, Waterborne
- I. SCAQMD South Coast Air Qaulity Management District
  - 1. SCAQMD-1113 SCAQMD Rule 1113, Architectural Coatings
  - 2. SCAQMD-1168 SCAQMD Rule 1168, Adhesive and Sealant Applications
- J. SSPWC Standard Specifications for Public Works Construction (California)

### 1.03 SUBMITTALS

### A. Action Submittal

- 1. Product Data for each paint system product and accessory item including certifications of the following
  - a. Recycled content, segregated by pre- and post-consumer percentages Rapidly Renewable Material Content VOC content
  - b. Distances from following material process locations to Site
    - 1) raw material harvest, collection or extraction
    - 2) product or component fabrication
    - 3) final material manufacture, if different than component fabrication
- 2. Shop Drawings of traffic and parking markings

# B. Record Submittals

1. Manufacturer's Application Instructions

### C. CALGreen Submittals:

1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.C.

### 1.04 QUALITY ASSURANCE

- A. Paints and Coatings: VOC content within limits set by SCAQMD-1113 or APCD-67 whichever is stricter.
- B. Adhesives and Sealants shall have VOC content within limits required by SCAQMD-1168 or APCD-67.21 which ever is stricter.
- C. California Green Building Standards Code, CALGreen 2016.
  - 1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
  - 2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.

# D. Regulatory Requirements

1. Pavement markings for designated accessible parking spaces and related pedestrian stripping shall conform to or CBC-11B whichever provides persons with disabilities greater protection.

- 2. Traffic control pavement and curb markings shall be in accordance with SSPWC, Sections 210-1.6 and 310-5.6.
- 3. Paint products shall dry to a finish as slip resistant as surrounding pavement.
- 4. Detectable warning textures shall be as specified in Section 32 13 13.
- E. Manufacturer: company with minimum 10-years' experience manufacturing traffic line paint products for commercial projects similar in scale, complexity and quality to those required for this Project.
- F. Installer: company with minimum 6-years' experience painting traffic and related pavement markings for commercial projects similar in scale, complexity and quality to those required for this Project.

# G. Field Samples

- 1. Provide field sample in form of digital PDF document, illustrating coating colors, width of stroke, thickness of application and dimensioning to Architect.
- 2. Location: acceptable to Architect.
- 3. Modify materials and methods of installation as required to obtain Architect's approval.
- 4. Document materials and methods used to obtain Architect's approval. Maintain at least one copy of this documentation in a readily accessible location on Site while this work is in progress.
- 5. Maintain access to and protect Field Samples from damage while this work is in progress.
- 6. Upon acceptance of related work, Field Samples in acceptable condition may remain as part of the work.

# 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in manufacturer's original, sealed containers with labels legible and intact.
  - 1. Labels shall 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.
- B. Store paint materials at ambient temperatures between 45- and 90-degrees-F, unless expressly permitted otherwise in manufacturer's printed instructions.

#### 1.06 MAINTENANCE

- A. For each color of pavement marking paint furnish, as Extra Material, a quantity equal to approximately 3-percent of quantity required for its installation rounded up to next higher five-gallon container of the paint.
  - 1. Extra Materials shall be from same production run as installed materials.
  - 2. In addition to manufacturer's label, label each container for color, dates and locations of related installations and shelf life.
  - 3. Deliver Extra Materials to Owner as directed.

# PART 2 - PRODUCTS

# 2.01 REGULATORY REQUIREMENTS

- A. Accessible parking spaces shall be located as near as practical to a primary entrance and shall be marked according to CBC Section 11B-208.3.1
- B. Surface slopes of accessible parking spaces and access aisles shall be the minimum possible and shall not exceed 2% slope in any direction. CBC Section 11B-502.4
- C. Loading and unloading access aisle shall be marked by a border painted blue. Within the blue border, hatched lines a maximum of 36" on center shall be painted a color contrasting with the parking surface, preferable blue or white. CBC Figures 11B-502.3.3.
  - 1. The words "NO PARKING" shall be painted on the surface within each access aisle in white letters a minimum of 12" high and located to be visible from the adjacent vehicular way.
- D. ISA Markings: Each accessible car and van space shall have surface identification complying with 11B-502.6.4.
- E. When blue color is used, it shall conform to Color No. 15090 per Federal Standard 595C.
- F. Painted lines and markings on pavement are recommended to be 3" wide minimum.

# 2.02 PAVEMENT MARKING PAINTS

- A. Acceptable Manufacturers. Products of following manufacturers form basis of design and quality intended for this Project.
  - 1. Dunn-Edwards Corporation, Los Angeles, CA
  - 2. Glidden Professional, Commerce, CA
  - 3. Frazee Paint and Wallcovering, Inc., Anaheim, CA
  - 4. Or equal, approved in accordance with Division 01 requirements for substitutions.
- B. Traffic Line Paint: lead and chromate free, ready mixed, water bourne emulsion type, complying with Fed.Spec TT-P-1952D with drying time of less than 45 minutes. Furnish paints in containers of at least 18 L (5 gallons).
  - 1. Colors
    - a. Accessible Markings for Parking Stalls, Passenger Drop-Off Area and Related Markings: Fed.Std 595B, Color No. 15090, Blue, except that International Symbol of Access and NO PARKING notices marked on pavement shall be white. Section 11B-502.6.4.
    - b. Other Parking Stall Lines and Traffic Control markings: white or yellow.
    - c. Fire Lane markings: red with white lettering.
    - d. Temporary Parking, markings: green with white lettering.
    - e. Passenger / Postal Loading Zones, markings: white with black lettering.
    - f. Commercial Loading Zone and Carpool Parking Space markings: yellow with black lettering.
  - 2. Acceptable Products
    - a. Dunn-Edwards, Vin-L-Stripe Traffic Paint, Vinyl Epoxy Emulsion, W801

- b. Glidden Pro, Traffic Paint 4810, Fast Dry Acylic
- c. Frazee, No. 506 Traffic Line Paint
- d. Or equal
- C. Reflective Paint: SSPWC Table 210-1.6.1(A) and 210-1.6.5 rapid dry paint.
  - 1. Reflective material: glass beads added to surface of final coat of paint prior to setting. Glass beads shall conform to Calif. State Specification 8010-004 (type II), applied mechanically at 8 lbs of beads per gallon of paint, dispensed by device developed for the purpose.
    - a. For thermoplastic paint glass beads may be added to directly to the paint per 210-1.6.1 with additionally adding 1 pound of beads per gallon.
  - 2. Color: White, Yellow, or Black per Cal Trans Manual.
  - 3. Acceptable Products: by Emedco Buffalo, NY, or equal.

# 2.03 ACCESSORIES

- A. Raised Pavement Markers: CALTrans Manual, Section 85, Type A-non-reflective white ceramic disks (Bott's Dots).
- B. Raised Pavement Markers: rectangular, raised, 4- by 4- by 3/4-inch, ASTM D 788, Grade 8 high-impact, plastic highway pavement markers with beveled edges and dual prismatic, reflective lenses.
  - 1. Reflector Color: white or amber except furnish blue for fire hydrant marker location.
  - 2. Acceptable Products: Hy-Viz, or equal.
- C. K-Rail Lightweight Plastic Water-Filled traffic control barriers.
  - 1. Material: Recyclable polyethylene
  - 1. Width: 24"
  - 2. Height: 46"
  - 3. Length: 6'-1".
  - 4. Weight: Empty: 130 lbs. Filled: 1500 lbs.
- D. Adhesive: ASTM C 881, Type IV Grade, 3, Class B epoxy type, rapid set, CALTrans Manual, Sections 85-1.055 and 95-2.04.

# PART 3 - EXECUTION

# 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive Work as instructed by product manufacturer.
- B. Do not begin installation until unsatisfactory conditions are corrected. Beginning installation means acceptance of existing conditions including the preparatory work of others, if any.

# 3.02 PREPARATION

- A. Clean pavement in immediate vicinity of markings as directed by paint manufacturer.
  - 1. Surfaces to be painted shall be clean and free of dust, dirt, grease, oil, water or other contaminates.

- 2. Existing lines to be removed shall be sandblasted clean.
- B. Do not apply traffic paint to AC paving until seal coat has been in place minimum of 10 days.

### 3.03 APPLICATION

- A. Apply paints by machine spray, airless sprayer, roller or brush to provide a minimum DFT of 15 mils. Precise edges are required; no overspray will be accepted.
  - 1. Stripping: single, 4 inch wide lines, unless double lines are shown on drawings.
- B. Perform Work in accordance with approved Shop Drawings and with SSPWC Section 310-5.6.8.
  - 1. Striping, pavement markings, and curb markings shall be in accordance with SSPWC Sections 210-1.6 and 310-5.6 or accessibility requirements, as applicable.
  - 2. Passenger Loading Zone. Paint accessible passenger transfer area as indicated.
- C. At Fire Lanes paint curbs, or if there is no curb, paint 6 inch red stripe and let dry. Then stencil 4-inch high lettering reading NO PARKING FIRE LANE at maximum 20 feet on center on painted curb or stripe, as applicable.
- D. At Temporary Parking, paint curbs and let dry. Then, stencil 4-inch lettering that reads TEMPORARY PARKING 20 MINUTES centered in each parking space.
- E. At Loading Zone, paint curbs and let dry. Then, stencil 4-inch high lettering that reads LOADING ZONE NO PARKING at maximum 30 feet on center on painted curb.
- F. At Carpool Parking, Spaces paint wheel-stops and let dry. Then, stencil 3-inch high lettering that reads CARPOOL PARKING ONLY.
- G. Install Raised Pavement Markers in accordance with CALTrans Manual, Section 85-1.06 with adhesive.

### 3.04 DEFECTIVE WORK

A. Remove any paint that demonstrates evidence of checking, cracking, peeling, discoloration, lack of bonding or poor coverage. Misplaced lines shall be completely removed by paint remover or wet abrasive-blasting in accordance with SSPWC, Section 310.5.6.3. Painting over misplaced lines will not be permitted. Provide new complying work without claim for change in Contract Sum or Schedule.



#### **SECTION 32 17 26**

# TACTILE/DETECTABLE WARNING SURFACE TILE

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

A. Surface Applied tactile tile modules where indicated.

### 1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Samples for Verification Purposes: Submit two tile samples minimum 6" by 8" of kind proposed for use.
- C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on Surface Applied tactile tile system as certified by a qualified independent testing laboratory.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

### 1.03 QUALITY ASSURANCE

- A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.
- B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces that comply with detectable warnings on walking surfaces section of Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.
- D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of "Detectable Warning". Section 11B-705.1.2.2 for "Curb Ramps" and Section 11B-705.1.2.5 for Hazardous Vehicle Areas".



- E. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1.
  - 1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90" min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.18" 0.22" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
    - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.
- B. Tiles shall be delivered to location at building site for storage prior to installation.

### 1.05 SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.
- B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.
- C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.
- D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

# 1.06 EXTRA STOCK

A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) percent of the supplied materials for each type, color and pattern installed.



# 1.07 WARRANTY (DETECTABLE WARNINGS AND DIRECTIONAL TEXTURE)

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detectable warnings and directional surface products that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
    - b. Degrade significantly means that product maintains at least 90 percent of its approved design characteristics, as determined by the authority having jurisdiction.
  - 2. Warranty Period: Five years from date of Final Completion.

#### PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - Engineered Plastics Inc, Armor Tile.
  - 2. ADA Solutions, Inc., North Billerica, MA.
  - 3. Or equal.
- B. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Sections 11B-705.2 and 11B-705.3, IRs 11B-2, 11B-3 and 11B-4 and the California Accessibility Reference Manual.
  - Truncated Domes: provide raised Detectable Warnings with diameter of 0.9 inch
    at base tapering to 0.45 inch at top, height of 0.2 inch, with center-to-center
    spacing of 2.3 to 2.4 inches and corner domes spaced at 0.896 inch from the
    corner edges of tile. Provide raised truncated domes in a square grid (in-line)
    pattern.
    - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
  - 2. Detectable Warning Texture (Truncated Domes): Plastics/Composites: Armor Tile, ADA Tactile Systems by Engineered Plastics Inc., North Billerica, or equal.
- C. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
- D. Homogenous glass and carbon reinforced composite that is colorfast and UV stable with the following characteristics:



Slip Resistance	C1028	0.98 dry, 0.94 wet
Accelerated Weathering	G26 (3,000 hours)	No Change
Wear Resistance	C501	564
Flame Resistance	E84	FSI=15
Water Absorption	D570	0.13%
Compressive Strength	D695	23,800 psi
Flexural Strength	D790	24,600 psi

E. Color: Yellow conforming to Federal Color No. 33538 of Federal Standard 595C. Color shall be homogeneous throughout the tile.

### 2.02 MATERIALS

- A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: 1/4" diameter x 1- 3/4" long, or manufacturer's recommended fasteners.
- B. Adhesive and Sealant: Manufacturer's standard.

# PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- B. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
- C. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Architect.
- D. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. Use thin permanent marker. Remove tile when done marking its location.
- E. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.
- F. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for minimum of 30 days.



- G. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
- H. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2" width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.
- I. Set the tile true and square to the curb ramp area as detailed in the design drawings.
- J. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3½" using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.
- K. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.
- L. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.
- M. Working in a sequence that will prevent buckles in the tile, proceed to drill and install all fasteners in the tile's molded recesses.
- N. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2" from the tile's perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.
- O. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.
- P. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.
- Q. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.



- R. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each. If tiles are custom cut to size, and if pre-molded recesses (to receive fasteners) are removed by the cut, then any truncated dome can be center-drilled with a ¼ inch through hole, and countersunk with a suitable bit, to receive mechanical fasteners. New holes should be created no closer to the edge of the tile than any of the other perimeter fastener pre-molded recesses. Care should be taken to not countersink too deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.
- S. Adhesive or caulking on the surface of the Tile can be removed with Acetone.

### 3.02 CLEANING AND PROTECTING

- A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.
- B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by methods recommended by manufacturer.



# **SECTION 32 17 26**

### TACTILE/DETECTABLE WARNING SURFACE TILE

### PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Surface Applied tactile tile modules where indicated per Architectural plan.

### 1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.
- B. Samples for Verification Purposes: Submit two tile samples minimum 6" by 8" of kind proposed for use.
- C. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on Surface Applied tactile tile system as certified by a qualified independent testing laboratory.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

# 1.03 QUALITY ASSURANCE

- A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.
- B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
- C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces that comply with detectable warnings on walking surfaces section of Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.
- D. California Code of Regulations (CCR): Provide only approved DSAAC detectable warning products as provided in the California Code of Regulations (CCR). Title 24, Part 1, Articles 2, 3 and 4 and Part 2, Section 205 definition of "Detectable Warning". Section 11B-705.1.2.2 for "Curb Ramps" and Section 11B-705.1.2.5 for Hazardous Vehicle Areas".

# **HMC** Architects

- E. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Section 11B-705.1.
  - 1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90" min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.18" 0.22" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
    - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.

### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.
- B. Tiles shall be delivered to location at building site for storage prior to installation.

### 1.05 SITE CONDITIONS

- A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.
- B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.
- C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal state and local laws and ordinances.
- D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

# 1.06 EXTRA STOCK

A. Deliver extra stock to storage area designated by engineer. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) percent of the supplied materials for each type, color and pattern installed.



# 1.07 WARRANTY (DETECTABLE WARNINGS AND DIRECTIONAL TEXTURE)

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detectable warnings and directional surface products that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
    - b. Degrade significantly means that product maintains at least 90 percent of its approved design characteristics, as determined by the authority having jurisdiction.
  - 2. Warranty Period: Five years from date of Final Completion.

# PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Engineered Plastics Inc, Armor Tile.
  - 2. ADA Solutions, Inc., North Billerica, MA.
- B. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Sections 11B-705.2 and 11B-705.3, IRs 11B-2, 11B-3 and 11B-4 and the California Accessibility Reference Manual.
  - Truncated Domes: provide raised Detectable Warnings with diameter of 0.9 inch
    at base tapering to 0.45 inch at top, height of 0.2 inch, with center-to-center
    spacing of 2.3 to 2.4 inches and corner domes spaced at 0.896 inch from the
    corner edges of tile. Provide raised truncated domes in a square grid (in-line)
    pattern.
    - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
  - 2. Detectable Warning Texture (Truncated Domes): Plastics/Composites: Armor Tile, ADA Tactile Systems by Engineered Plastics Inc., North Billerica, or equal.
- C. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.
- E. Color: Yellow conforming to Federal Color No. 33538 of Federal Standard 595C. Color shall be homogeneous throughout the tile.

# 2.02 MATERIALS

# **HMC** Architects

- A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: 1/4" diameter x 1- 3/4" long, or manufacturer's recommended fasteners.
- B. Adhesive and Sealant: Manufacturer's standard.

#### PART 3 - EXECUTION

# 3.01 INSTALLATION

- A. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- B. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.
- C. Ensure that surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to Architect.
- D. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. Use thin permanent marker. Remove tile when done marking its location.
- E. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.
- F. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for minimum of 30 days.
- G. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.
- H. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2" width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.
- I. Set the tile true and square to the curb ramp area as detailed in the design drawings.
- J. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3½" using the recommended diameter bit.

# **HMC** Architects

Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.

- K. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or blow away dust and set the mechanical fastener as described below, before moving on to the next hole.
- L. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.
- M. Working in a sequence that will prevent buckles in the tile, proceed to drill and install all fasteners in the tile's molded recesses.



- N. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2" from the tile's perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.
- O. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.
- P. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other, in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.
- Q. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is advisable. All cuts should be made prior to installation of the tiles.
- R. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each. If tiles are custom cut to size, and if pre-molded recesses (to receive fasteners) are removed by the cut, then any truncated dome can be center-drilled with a ¼ inch through hole, and countersunk with a suitable bit, to receive mechanical fasteners. New holes should be created no closer to the edge of the tile than any of the other perimeter fastener pre-molded recesses. Care should be taken to not countersink too deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.
- S. Adhesive or caulking on the surface of the Tile can be removed with Acetone.

# 3.02 CLEANING AND PROTECTING

- A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.
- B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.
- C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by methods recommended by manufacturer.

# **END OF SECTION**



### **SECTION 32 31 13**

# **FENCES AND GATES**

#### PART 1 - GENERAL

# 1.01 SECTION INCLUDES

- A. Fence framework, fabric, and accessories
- B. Excavation for post bases.
- C. Concrete anchorage for posts and center drop for gates.
- D. Swing gates, signs and related hardware.
  - 1. Manual Operation
- E. Related Section
  - 1. Section 32 13 13, Sitework Concrete.
- F. Lock Box Fire-Department-Access padlock.
- **G.** Tennis fabric.

#### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. ASTM International
  - 1. ASTM A 392 Zinc-Coated Steel Chain-Link Fence Fabric
  - 2. ASTM A 824 Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
  - ASTM B221 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 4. ASTM F 552 Terminology Relating to Chain Link Fencing
  - 5. ASTM F 567 Installation of Chain-Link Fence
  - 6. ASTM F 626 Fence Fittings
  - 7. ASTM F 900 Industrial and Commercial Swing Gates
  - 8. ASTM F 969 Construction of Chain-Link Tennis Court Fence
  - 9. ASTM F 1043 Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
  - 10. ASTM F 1083 Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
  - 11. ASTM F 1184 Industrial and Commercial Horizontal Slide Gates
  - **12.** ASTM F 2049 Fences/Barriers for Public, Commercial, and Multi-Family Residential Use Outdoor Play Areas.
  - 13. ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process



- C. SSPWC Standard Specifications for Public Works Construction, Latest Edition
- D. CLFM Chain Link Fence Manufacturer's Institute
- E. CBC 2016 California Building Code
  - 1. Chapter 10, Means of Egress
  - 2. Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
  - 3. Chapter 19A, Concrete

### 1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in commercial quality chain link fencing with five years experience.

# 1.04 SUBMITTALS

- A. Shop drawings including plan layout, grid, spacing of components, accessories, fittings, hardware, footings, anchorages and schedule of components.
- B. Product data.
- C. Manufacturer's installation instructions.
- D. Three samples illustrating each fence fabric finish.

## 1.05 WARRANTY

A. Provide two-year warranty to insure materials against rusting or breakdown of finish. Provide adjustments as needed to assure continued smooth operation of gates.

#### PART 2 - PRODUCTS

# 2.01 MATERIALS

- A. Acceptable Manufacturers
  - 1. Master-Halco/Anchor Fence Inc., Baltimore, MD
  - 2. Boundary Fence and Railing Co., Richmond, NY.
  - 3. Reeves Southeastern Wire Corp., Tampa, FL.
  - 4. Ameristar Fence Products, Tulsa, OK.
  - 5. Or equal in accordance with Division 01, General Requirements for substitutions.
- B. Framework: ASTM F1043; Type I Group IA, Schedule 40, ASTM F1083, 50,000 psi, hot-dipped galvanized steel pipe, minimum 1.8 oz/sq.ft., Sized in accordance with Table 206-6.2, Standard Specifications for Public Works Construction. One piece without joints in accordance with CLFM I.
  - 1. EXIT Gates: galvanized square tube, ASTM A500, Grade B, for square pipe at lintels and gate posts, minimum galvanizing coating of 1.8 ounces per sq. ft. 2-1/2 inches square.



- C. Fabric: Type II ASTM A817, Class 2 ASTM A392, Class 2 (not less than 2 oz/ft sq.), galvanized before (G.B.W.) weaving, 2-inch mesh, 9 gauge, interwoven, top and bottom knuckled selvage. Single width fabric.
  - 1. Fabric at Enclosures: 1-3/4 inch mesh, 11 gage, single width fabric.
    - a. "Tennis" windscreen C-95 woven open mesh 100% polypropylene with 78 percent wind break, 6 x 12 inch cutouts at 10 feet o.c., reinforced tape at #2 brass grommets at 18 inches centers at perimeter, attach screen to chain link fence with 11 gauge brass hog rings. Color: Dark Gray. West Coast Netting, Kingman, AZ., Roxford Fordell, Los Angeles, CA, Shade Tree, Cornelia, Georgia or equal as approved in accordance with Division 01, General Requirements for substitutions.
    - b. Height: as indicated

# 2.02 CONCRETE MIX

- A. Concrete: Normal Portland cement; 3,000 psi at 28 days; 4 inch slump, conforming to ACI 318-11 Section 5.2, CBC Section 1905A and Section 32 13 13 Sitework Concrete.
  - 1. Design Mix: Conform to Section 1905A.1 CBC.
  - 2. Reinforcement: per Section 32 13 13 and as indicated on drawings.

# 2.03 COMPONENTS

A. Nominal pipe size (NPS) and weight (Class 1) in pounds per lineal foot:

NPS

Pounds/LF

1.	1-1/4:	2.27
2.	1-1/2:	2.72
3.	2:	3.65 (3.87 for sq. pipe at exit gate frames)
4.	2-1/2:	5.79 (5.79 for sq. pipe at exit gate posts)
5.	3:	7.58
6.	3-1/2:	9.11
7.	6:	18.97
8.	8:	24.58

B. Line Posts for fencing

Fence height in feet

Outside diameter in inches
5

C. Terminal Posts - end, corner and slope.

Fence height in feet Outside diameter in inches

D. Swing gate posts, single leaf; opening widths in feet:

Up to 6 wide
 6-13 wide
 13-18 wide:
 18 or more wide:
 2" diameter
 3-1/2" diameter
 6" diameter
 8" diameter

E. Swing gate posts, double leaf, opening widths in feet:

1. Up to 12 wide 2-1/2" diameter 2. 12-26 wide 3-1/2" diameter



3. 26-36 wide 6" diameter 4. 36 or more wide: 8" diameter

- F. Top rail, mid rails, and braces: 1-5/8 inches diameter, plain end, sleeve coupled.
- G. Top Rail Expansion Sleeve: 7 inches expansion sleeve with spring.
- H. Swing Gate Frames: 1-1/2 inches diameter
- I. Stiffeners for swing gates:1-1/4 inches diameter
- J. Caps: Domed cast steel or malleable iron, galvanized and coated; sized to post dimension, set screw retained.
- K. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings: Galvanized Steel.
- L. Tension Wire: 7 gage thick coil spring steel, single strand, galvanized.
- **M.** Lock Box: #1650 Medium Duty surface-mounted as manufactured by the Knox Company, Newport Beach, CA.
- N. Truss Rod and Tightener: 3/8-inch diameter; furnish one at each end, pull, and gate post, and at both sides of corner posts.
- O. Double Gates: Master-Halco Series 17200, latch assembly with drop rod (cane bolt).

# 2.04 PADLOCK

- A. Non Fire Access Padlock: 5 pin cylinder, corrosion resistant, hardened steel shackles, 5/16 inch shackle diameter, No. 1158A54 by McMaster-Carr, Los Angeles, CA, or equal as approved in accordance with Division 01, General Requirements for substitutions, master keyed to building standard one per gate.
- B. Fire Department Access Padlock: heavy-duty brass body, 2-1/4 in. H x 2 in. W x 1-1/4 in. D. 3/8 in. diameter hardened steel shackle, 1-3/4 in. long shackle. Model No. PL-1W with EPDM elastomeric protection by Medeco Company, or equal as approved in accordance with Division 01, General Requirements for substitutions, one per fire-access gate.

# PART 3 - EXECUTION

# 3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with Section 304-3, SSPWC, ASTM F567 and manufacturer's instructions.
  - 1. Line post-footing diameter:18 inches min. Embed posts into footing 6 inches less than the depth of the footing. Slope at top to shed water, 1/4" per foot.
  - 2. Line post-footing minimum depth: 8 ft. minimum.
  - 3. Gate post-footing diameter: 18 inches.
  - 4. Gate post footing minimum depth: 8 ft.



- 5. For fencing higher than 12 feet: footing depth of 60" minimum and diameter of 36" minimum unless noted otherwise on drawings.
- 6. Reinforcing: per Section 32 13 13 and as indicated on drawings.
- 7. Posts set in hard rock concrete: drill holes 1 inch larger than post and set in non-shrink grout.
- B. Provide fence height as indicated on Drawings.
- C. Space line posts at intervals not exceeding 10 feet.
- D. Set terminal, gate and line posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- E. Provide top rail through line post tops and splice with 7 inch long rail sleeves, outside sleeve type.
- F. Brace each gate, corner, and end posts to adjacent line posts with horizontal center brace rail and diagonal truss rods. Install brace rail, one bay from end and gate posts.
- G. Center Rails: Install mid rails between posts with fittings and accessories for fabric height 12' and over, inclusive.
- H. Install center and bottom brace rail on gate leaves, welded construction.
- I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- J. Position bottom of fabric 2 inches above finished grade.
- K. Fasten fabric to top rail, line posts, braces and bottom tension wire with tie wires maximum 16 inches on centers, one complete wrap.
- L. Attach fabric to end, corner and gate posts with tension bars and tension bar clips.
- M. Install bottom tension wire stretched taut between terminal posts, (corner posts shall have brace rail).
- N. Double Gates: Provide drop rod to hold inactive leaf. Provide locking device and padlock eyes as an integral part of latch, requiring for locking both gate leaves.
- O. Provide concrete center drop and drop rod retainers at center of double gate openings, except gates with panic hardware.
- P. Weld mount galvanized steel plate to accept Lock Box nearest latch with access to door from outside of fence enclosure for Fire Department. Touch up all welding marks with Solder Zinc Alloy for Repair: Welco Gal-Viz self-fluxing solder alloy, Galvalloy, Galvabar or equal, ASTM A780, paragraph A1. Repair Using Zinc-Based Alloys.



#### 3.02 SWING GATES

- A. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC 11B-404.
- B. Gate Frames: 1-1/2 inch diameter steel pipe, welded corners, hot dip galvanized after fabrication.
  - 1. Exit Gate Frames: 2 inch square steel pipe, welded corners, hot dip galvanized after fabrication.
- C. Sizes: As indicated on the Drawings, minimum widths of gates shall not be less than 36" (clearance of opening width shall not be less than 32 inches).
- D. Hardware: Heavy-duty, galvanized ferrous metal industrial quality as manufactured by Master-Halco/Anchor Fence Inc., Baltimore, MD. Von Duprin, Adams Rite, Sargent, Trimco or equal as approved in accordance with Division 01, General Requirements for substitutions.
- E. Hinges: Structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180 degrees inward as indicated on drawings.
  - 1. Latch: Fork type latch capable of retaining gate in closed position, except gates with exit devices (panic hardware); Master-Halco, Series 16000 or approved equal.
    - a. At accessible gates, hardware shall not require pinching, grasping or twisting motion. Weld 1-1/2 inches by 2-1/2 inches by 1/4 inch diameter U-shaped galvanized rod to fork latch, both sides, for ADA accessibility as indicated on Drawings. Dress welded joints, leaving no burrs, or sharp abrasive corners, edges or surfaces, in accordance with NOMMA Guidelines for Finish 1. Touch up with Solder Zinc Alloy for Repair: Welco Gal-Viz self-fluxing solder alloy, Galvalloy, Galvabar or equal, ASTM A780, paragraph A1. Repair Using Zinc-Based Alloys.
  - 2. Locks: Self-latching bolt and deadbolt, 3/4 inch diameter, adjustable, lockable, with lever handle, by Ameristar Lock or equal, keyed lock. Hardware shall not require pinching, grasping or twisting motion. The lever of lever-activated latches or locks for an accessible gate shall be curved with a return to within ½" of the (face of) gate to prevent catching on the clothing or persons.
  - 3. Exit Device at Exit Gates only, outswing in accordance with 2016 CBC Sections 1008.1.9, 1008.1.10, and 1008.2, mounted 36" to 44" above finish floor. Exit Device (panic hardware) shall be mounted to provide 36" clear minimum below the device. Unlatching force not exceed 15# applied in direction of travel.
    - a. Panic Bar: Exit Device; Von Duprin Rim Device 99NL-OP (Night Latch, Cylinder Only) Series exit device, anodized aluminum finish, with 299 strike and VR914NL Vandal Resistant Trim, at single gates, devices in exit pathways where shown on drawings, include cylinders, attach to gate post. Grip trim on exterior of gate.
    - b. Accessories: 4" x 3" x ½" x 8" high galv. steel angle welded to strike-side frame and 1" x 3" x ½" thick latch bolt keeper.
    - c. Fabricate Steel Lock Box, galvanized, 16 ga x 3" high x 8" wide x 1-3/4" thick to encase lockset, weld all joints and grind smooth, touch up with galvanizing compound.



- 4. Locking: Provide padlock capability on non-pedestrian gates only. Do not install padlock capability on Exit Gates, gates on Path of Travel with Exit Devices and other pedestrian gates.
- 5. Gate Hardware Mounting: Mount at 34 to 40 inches above walking surface and according to 2016 CBC Sections 1008.1.9 and 1008.2 and 11B-404.2.7, 11B-404.2.9.
  - a. Provide strike strap.
  - b. Bolt keeper.
- 6. Install 0.125 inch thick aluminum protective plate 24 in. high by width of gate behind panic device centered at 40 in. above finish surface. Secure to gate frame with #8 stainless steel screws at 6 in on center.
- 7. Install 0.125 inch thick aluminum kickplate 10 inches high on push side (For larger gates install at both sides), CBC 11B-404.2.10, parts creating horizontal or vertical joints in these surfaces shall be within 1/16" of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. Secure with #8 stainless steel screws 4 places each kickplate minimum. Clear space below gate shall be 3 inches maximum from walking surface on both sides of the gate.
- 8. Gate Closer for push out installation: ANSI A156.4, Grade 1. Install hydraulic gate closer, Model Dor-O-Matic SC71, Norton 7501, LCN 4041, or equal. Arm Rw/PA (regular arm with parallel arm bracket), adapter offset shoe, plate and spacer, TBSRT (thru bolt self-reaming and tapping) screws, plate. ADA compliant. With metal cover, aluminum finish. Attached to 2-1/2 inches square lintel. Opening force to be limited to 5 lbs maximum.

#### 3.03 TESTING

A. At Architect's option, Contractor shall be required to cut any pipe column after installation to confirm requirements of this Specification. If conformance is confirmed, replacement members shall be installed at Owner's cost. Components not meeting required standards shall be replaced.

#### **END OF SECTION**



# **SECTION 32 32 23**

#### SEGMENTED BLOCK RETAINING WALL

SECTION 1 PART 1: GENERAL

# 1.1 Scope

Work includes furnishing and installing modular concrete block retaining wall units to the lines and grades designated on the construction drawings and as specified herein.

#### 1.2 Reference Standards

- A. ASTM C1372 Standard Specification for Segmental Retaining Wall Units.
- B. ASTM C1262 Evaluating the Freeze thaw Durability of Manufactured CMU's and Related concrete Units
- C. ASTM D698 Moisture Density Relationship for Soils, Standard Method
- D. ASTM D422 Gradation of Soils
- E. ASTM C140 Sample and Testing concrete Masonry Units

# 1.3 Delivery, Storage, and Handling

- A. Contractor shall check the materials upon delivery to assure proper material has been received.
- B. Contractor shall prevent excessive mud, cementitious material, and like construction debris from coming in contact with the materials.
- C. Contractor shall protect the materials from damage. Damaged material shall not be incorporated in the project (ASTM C1372).

# 1.4 Contractor Requirements

Contractors shall be trained and certified by local manufacturer or equivalent accredited organization.

A. Contractors shall provide a list of projects they have completed.

# PART 2: MATERIALS

#### 2.1 Modular Wall Units

- A. Wall units shall be Allan Block Retaining Wall units per plans or approved equal as produced by a licensed manufacturer.
- B. Wall units shall have minimum 28 day compressive strength of 3000 psi (20.7 MPa) in accordance with ASTM C1372. The concrete units shall have adequate freeze-thaw protection with an average absorption rate in accordance with ASTM C1372 or an average absorption rate of 7.5 lb./ft³ (120 kg/m³) for northern climates and 10 lb./ft³ (160 kg/m³) for southern climates.
- C. Exterior dimensions shall be uniform and consistent. Maximum dimensional deviations on the height of any two units shall be 0.125 in. (3 mm).
- D. Wall units shall provide a minimum of 110 lbs total weight per square foot of wall face area (555 kg/m²). Hollow cores to be filled with wall rock and compacted by using plate compactor on top of wall units (see section 3.4). Unit weight of wall rock in cores may be less than 100% depending on compacted base.
- E. Exterior face shall be textured. Color as specified in the plans.



#### 2.2 Wall Rock

A. Material must be well-graded compactable aggregate, 0.25 in. to 1.5 in., (6 mm - 38 mm) with no more than 10% passing the #200 sieve. (ASTM D422)

### 2.3 Infill Soil

- A. Infill material shall be as specified in Section 32 93 00. Unsuitable soils for backfill (heavy clays or organic soils) shall not be used in the soil mass
- B. The contractor shall submit a fill soil sample and specifications to the Landscape Architect for approval.

# 2.4 Adhesive

A. Adhesive for securing cap blocks to wall and bottom course of wall to asphalt shall be SRW products retaining wall SP adhesive, solvent based meeting ASTM D3498 and C557requirements, or approved equal.

#### PART 3: WALL CONSTRUCTION

#### 3.1 Excavation

- A. Contractor shall excavate to the lines and grades shown on the construction drawings. Contractor shall use caution not to over-excavate beyond the lines shown, or to disturb the base elevations beyond those shown.
- B. Contractor shall verify locations of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall construction.

#### 3.2 Foundation Preparation

- A. All walls are to be set on an asphalt pavement foundation.
- B. The contractor shall inspect the installed pavement and base to assure that the pavement will provide an adequate foundation for the segmented block planter walls.

#### 3.3 Unit Installation

- A. Install units in accordance with the manufacturer's instructions and recommendations for the specific concrete retaining wall unit, and as specified herein.
- B. Ensure that units are in full contact with the asphalt base. Proper care shall be taken to develop straight lines on base pavement as per wall layout.
- C. Glue base blocks to asphalt with adhesive per block manufacture's recommendations.
- D. Fill all cores and with wall rock. Use planter fill soils behind the. Check again for level and alignment. Use a plate compactor to consolidate the area behind the base course. All excess material shall be swept from top of units.
- E. Install next course of wall units on top of base course. Position blocks to be offset from seams of blocks below. Perfect "running bond" is not essential, but a 3 in. (75 mm) minimum offset is recommended. Check each block for proper alignment and level. Fill all cavities in wall units with wall rock. Place infill soil in uniform lifts not exceeding 8 in. (200 mm). Compaction requirements for all soils in areas in, around and behind the reinforced mass shall be compacted to 80% of maximum Standard Proctor dry density (ASTM D698) with a moisture content control of +1% to -3% of optimum.
- F. Install each subsequent course in like manner. Repeat procedure to the extent of wall height.



G. As with any construction work, some deviation from construction drawing alignments will occur. Variability in construction of SRWs is approximately equal to that of cast-inplace concrete retaining walls. As opposed to cast-in-place concrete walls, alignment of SRWs can be simply corrected or modified during construction. Based upon examination of numerous completed SRWs, the following recommended minimum tolerances can be achieved with good construction techniques.

> Vertical Control - ±1.25 in. (32 mm) max over 10 ft. (3 m) distance Horizontal Location Control - straight lines ±1.25 in. (32 mm) over a 10 ft. (3 m) distance

Rotation - from established plan wall batter: ±2.0°

**END OF SECTION** 



# **SECTION 32 80 00**

#### IRRIGATION SYSTEM

### PART I: GENERAL

#### 1.01 QUALITY ASSURANCE

- A. All local, municipal, county and state laws, safety orders, rules and regulations governing or relating to any portion of the work depicted on these plans are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the contractor. Notify the Landscape Architect prior to installation in the event any equipment or methods indicated on the drawings or specifications conflict with local codes.
- B. Verify the locations of all existing utilities, structures, and services before commencing work. The locations of utilities, structures, and services shown on these plans are approximate only. Any discrepancies between these plans and actual field conditions shall be reported to the Owner or Landscape Architect.
- C. Obtain the pertinent Landscape Architectural and or architectural plans before commencing work.
- D. Obtain and pay for all necessary permits and inspections required by authorities stated above to perform the work indicated herein before commencing work.
- E. Notify the Landscape Architect prior to commencing work, and be responsible for coordinating work with the Owner, Landscape Architect, other construction trades, and governing agencies. Cause minimum interference with the work, materials, or equipment of other contractors.
- F. Irrigation plan is diagrammatic only. Refer to the irrigation legend and details for equipment and installation.
- G. Notify the Landscape Architect prior to commencing work in the event of conflicts between the drawings and specifications.
- H. Prior to the submission of a bid, the contractor shall examine the site and the complete drawings and specifications for the project in addition to the sprinkler irrigation portion of the work.

## 1.02 SCOPE OF WORK

- A. The work consists of furnishing all labor, materials, machinery, and processes required to complete the sprinkler irrigation system as shown on the drawings and described herein.
- B. The intent of the drawings and specifications is to indicate and specify a complete sprinkler system, installed ready for use without further cost in labor or material to the Owner.



C. The contractor shall be responsible for all work to be performed under this contract. No subcontractor shall relieve the contractor of his liability to complete the work as shown on the drawings and specifications in a timely manner.

#### 1.03 PROTECTION

- A. Use all means necessary to protect all materials of this section before, during, and after installation and to protect all objects designated to remain.
- B. In the event of damage, or theft immediately make all repairs and replacements necessary at no additional cost to the Owner.
- C. The Contractor shall protect all existing utilities and features on and adjacent to the project site from damage as a result of construction or malfunction during construction. Contractor shall repair, at his own expense, all damage resulting from his operations or negligence.
- D. The contractor shall carefully note all finished grades before commencing work. Any finished grade changed during the course of his work shall be restored to the original contours.

# 1.04 SUBMITTALS

- A. The Contractor shall furnish the articles, equipment, materials or processes specified in name on the drawings. No substitutions will be allowed without prior written approval by the Landscape Architect. Equipment or materials furnished or installed without the prior approval of the Landscape Architect may be rejected and the contractor required to remove such materials from the site at his own expense.
- B. Submit catalogue data and full descriptive literature for approval of items different than those specified.
- C. Submit record drawings in accordance with Part 3.

# 1.05 EXTRA MATERIALS / MATERIALS TO BE FURNISHED

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below. Package them with protective covering for storage and label clearly describing contents.
  - 1. Emitter tubing: (2) 50' rolls.
  - 2. The contractor shall provide two sets of sprinkler wrenches for adjusting, cleaning, or disassembling each type of sprinkler.
  - 3. Provide two keys for each automatic controller.
  - 4. Provide two guick coupler keys with hose swivels.
  - 5. Provide two each of any special tools required for other equipment.
  - 6. Two service manuals for all equipment shall be furnished to the Owner. Manuals may be loose leaf and should show drawings or exploded views of equipment and catalogue number.
  - 7. Operating instructions for all equipment shall be furnished.



# PART 2: PRODUCTS

### 2.01 General

A. All equipment and materials shall be new and unused prior to installation.

# 2.02 Brass Pipe and Fittings

- A. Brass pipe shall be heavy wall type, with threads complying to A.S.A. specifications.
- B. Fittings to be used with brass pipe shall be case brass or case bronze threaded joint, and shall comply with A.S.A. specifications. Threads on pipe and fittings shall be taper type.

# 2.03 Plastic Pipe and Fittings

- A. Plastic pipe shall be extruded from 100% virgin polyvinyl chloride (PVC) type 1, grade 11 (class 1220) as manufactured by Lasco, Johns-Manville, or equal.
- B. All plastic pipe shall be continuously and permanently marked with the following information: manufacturer's name, nominal pipe size, PVC 1220, SDR (standard dimension ratio or pressure rating in psi).
- C. Pipe shall be of the size and class or schedule as noted in the irrigation legend. Exposed pipe shall be "Brownline " UVR PVC or equal.
- D. Plastic fittings shall be PVC 11, IPS, Schedule 40 NSF and Schedule 80 threaded and or slip fittings as shown in the details.
- E. All threaded nipples shall be standard weight schedule 80 molded threads. Threaded nipples exposed above grade shall be gray in color.
- F. Solvent to be used for joining plastic pipe and fittings shall be as per the pipe manufacturers recommendations.

#### 2.04 SLEEVING

A. Sleeve all mainline and lateral lines with PVC. SCH. 40 pipe twice the diameter of the sleeved line where it passes under paved areas wider than four feet. Extend sleeve 12" beyond the edge of the pavement.

## 2.05 WIRING

- A. Control Wire: Awg-uf, #14 min. direct-burial type. Common wire shall be black. Use alternate colors(s) for control wires.
- B. Wire connections: Made with "Pen-tite" connectors (or equal). Locate mid wire splices in pull box (8" round plastic valve box).
- C. Higher voltage connections or 110 v shall be made by clamp and shall be weather protected per local codes.



D. Other equipment shall be as specified in the irrigation legend on the drawings.

#### 2.06 ASSEMBLIES

A. All threaded pipe and fittings shall be assembled using Teflon tape or equal, applied to the male threads only.

# 2.07 EQUIPMENT

A. Quick coupling valves, controllers, remote control (automatic) valves, ball valves, gate valves, sprinkler heads, backflow prevention units, and other equipment shall be as specified in the irrigation notes and legend on the drawings.

#### 2.08 VALVE BOXES

- A. All remote control, gate, ball, and isolation valves shall be housed in plastic valve boxes as detailed. Valve boxes shall be as manufactured by Brooks or equal.
- B. Valve boxes shall be lock top or bolted. Provide two keys minimum for lockable boxes.
- C. Valve box lids shall be marked as noted in the details.

#### 2.09 CHECK VALVES

A. Anti-drain valves shall be of heavy duty virgin PVC construction with F.I.P. thread inlet and outlet. Internal parts shall be stainless steel and neoprene. Anti-drain valve shall be field adjustable against drawout from 5 to 40 feet of head. Anti-drain valve shall be Valcon ADV or approved equal.

#### PART 3: EXECUTION

#### 3.01 SITE CONDITIONS

- A. All scaled dimensions are approximate. The contractor shall check and verify all dimensions on the site prior to proceeding with the work of this contract.
- B. The installation of all sprinkler materials, including pipe shall be coordinated with the planting plans to avoid interfering with tree, shrub, or other plant locations.

#### 3.02 WATER SUPPLY

A. The contractor shall connect to the water source as indicated on the drawings. Verify static pressure as stated on the plans prior to beginning work. Notify the Landscape Architect promptly if static pressure or point of connection differ from that shown on plans.



#### 3.03 SPRINKLER HEAD LOCATIONS

- A. Layout sprinkler heads and make minor adjustments required due to differences between site and drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional costs to the Owner. When directed by the Landscape Architect the layout shall be approved prior to installation.
- B. Do not willfully install the sprinkler system as indicated on the drawings when it is obvious in the field that unknown obstructions or grade differences exist that might not have been considered during Landscape Architecting. Such obstructions or differences shall be brought to the attention of the Landscape Architect.

# 3.04 VALVE LOCATIONS

- A. Backflow prevention devices shall not be located in turf areas unless specifically indicated on drawings.
- B. Automatic valves shall be grouped in manifolds, with valve boxes located approximately 12" from the edges of walks and paths. Do not locate manifolds in areas where they would result in gaps in hedge plantings or prevent trees from being located per plans.
- C. Paint valve and controller number on top of automatic value box lids. Secure a plastic tag with the valve number embossed onto each automatic valve.
- D. Check valves and anti-drain valves shall be installed where indicated, and where necessary to prevent water flow from lower elevation sprinkler heads when irrigation system is turned off.

#### 3.05 PIPE AND PIPE DEPTH

- A. All pressure mainlines shall be buried eighteen (18) inches deep, minimum.
- B. All lateral piping shall be buried twelve (12) inches deep, unless otherwise indicated.
- C. Pressure mains under paving shall be 30" deep minimum. Non-pressure laterals under paving shall be 24" deep minimum.
- D. All PVC pipe 2" and smaller shall be cut with a pipe cutting tool. Saw cuts are not allowed.
- E. Pipes placed in joint trenches shall be 18" apart minimum.

# 3.06 TRENCHING AND BACKFILLING

A. Make all excavations in open cut to width and depth necessary to construct the work in accordance with the Drawings and or as specified by the Landscape Architect. Exercise carefully to carry the excavation to the proper line and grade and to provide an even, uniform bearing surface for all piping.



- B. The minimum allowable trench width is eight inches (8").
- C. Hand trim excavations to required elevations. Do not over excavate. Remove large stones or other hard matter which could damage pipe.

# E. Backfilling

- 1. Backfill for trenching shall be compacted to dry density equal to the adjacent undisturbed soil in planting areas, and to 90% under paved areas. Backfill shall conform to the adjacent grades without dips, sunken areas, humps, or other irregularities. Place excavated material in six inch (6") layers, loose measure, and thoroughly tamp under and around the pipe across the full width of the trench. Provide moist, not wet, backfill. Include no stones larger than two inches (2").
- Allow for settlement. In the event of backfill settlement, the Irrigation Contractor shall perform required repairs at this own cost. Contractor shall be responsible for any settling of trenches from his work for a period of one year from acceptance by Owner.
- 3. Trenches shall be backfilled promptly after the open trench inspection.

# 3.07 ELECTRICAL

- A. Verify power sources as shown on the drawings.
- B. The contractor shall be responsible for making 110 volt electrical connections to the automatic controller, and for connecting remote control valves to the controller. All electrical work shall be in accordance with local codes and/or ordinances.
- C. Control wires shall be installed with one foot of excess wire (coiled) at the end of each wire run, and at 100 foot intervals for runs over 100 feet. Coils shall be in 8" round valve boxes.
- D. Run one extra hot wire and one common wire to the end of each circuit.
- E. Control wires shall be installed in grey schedule 40 PVC conduit.
- F. All control wiring shall be tested for continuity, open circuits and unintentional grounds prior to connecting equipment. The minimum insulation resistance to ground shall be fifty (50) megohms. Any wiring not meeting this requirement shall be replaced at the contractor's expense.
- 3.08 PRESSURE TESTING Prior to backfilling irrigation trenches:
  - A. All mainlines in the system shall be capped and hydrostatically pressure tested at 125 P.S.I. for a period of 24 hours with 0 P.S.I leak down. Any leaks found shall be corrected by removing and replacing the leaking pipe or fittings, and installing new material in its place.
  - B. All laterals shall be pressure tested at design pressure for four hours.



- C. The contractor shall not allow or cause any of this work to be covered until it has been inspected, tested, and approved by the Landscape Architect.
- D. Contact Landscape Architect a minimum of 48 hours prior to performing pressure tests. The Landscape Architect may elect to have the construction foreman observe the results of the test and document the results in the minutes of a regular construction progress meeting.

# 3.09 FLUSHING

- A. After all new PVC pipe, lines, and risers are in place and connected, all necessary diversion work has been completed, and prior to the installation of heads, the control valves shall be opened and a full head of water used to flush out the system.
- B. Cap off each head in sequence, from the control valve to the end of the line. Proceed to the next head only after the flow of water is clean and free of dirt, grit, and particulate matter.

#### 3.10 SPRINKLER COVERAGE

- A. Irrigation Contractor shall adjust all sprinkler heads to ensure an even coverage and to keep spray off of buildings, walls, walks, and drives.
- B. Adjust sprinkler heads on a daily basis as the system is being balanced throughout the construction and maintenance periods. Overspray and overwatering are to be kept to an absolute minimum.
- C. If it is determined that adjustments in the irrigation equipment or nozzle changes will provide proper and more adequate coverage, make necessary changes without additional cost to the Owner.

#### 3.11 CLEAN-UP

A. Upon completion of the work, make the ground surface level, remove excess materials, rubbish, debris, etc. and remove construction and installation materials from the premises.

#### 3.12 RECORD DRAWINGS

- A. The contractor shall furnish to the Owner a complete set of "as-built" drawings on reproducible media showing exact locations of all items installed. Corrections and changes are to be drawn in red ink. Drawings are to be legible and accurate. Dimension locations of valves, mainlines, control wires, water sources, and other equipment from two visible stationary points. These are to be delivered on or before final inspection and approval.
- B. A reduced irrigation plan indicating all irrigation systems and their appropriate sequenced control valve shall be laminated in clear plastic and mounted on the inside cover of each irrigation controller. The drawing shall clearly show locations of mainline, numbered control valves (and manifolds), shut off valves, and valve coverage areas.



#### 3.13 INSPECTIONS

- A. In no event shall the Contractor cover-up or otherwise remove from view any work under this contract without the prior approval of the Owner. Any work covered prior to inspection shall be uncovered by the Contractor at the Contractor's expense.
- B. Mainline pressure test and trench depth inspections shall be made prior to backfilling of trenches.
- C. When the irrigation system is completed and prior to planting, the Contractor shall in the presence of the Owner's authorized representative perform a coverage test on all planting areas to ensure it is complete and adequate. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage at his own cost.
- D. Notify the Owner in writing seven days prior to final inspection at the end of the maintenance period. Final inspection will be to insure that the system is fully operational, and that all heads, valves, and watering sequences have been adjusted for the proper irrigation of the plantings.
- E. Show evidence that the Owner has received all required accessories, charts, record drawings, etc. at the time of final inspection. The maintenance period may be extended if these materials have not been delivered.

#### 3.14 MAINTENANCE AND GUARANTEE

- A. Irrigation Contractor shall maintain the irrigation system for a period of ninety (90) days after pre-maintenance walk-thru, and shall water on a daily basis, or as required by plantings and weather conditions.
- B. Irrigation Contractor shall guarantee the entire irrigation system as to materials and workmanship for a period of one (1) year from final acceptance by the Owner. Should any operational difficulties in connection with the irrigation system develop within the guarantee period, which in the opinion of the Owner may be due to workmanship or materials, said difficulties shall be immediately corrected by the Contractor at no additional cost to the Owner. Manufacturers warranties shall not relieve the Contractor of his liability under the guarantee.

**END OF SECTION** 



# **SECTION 32 93 00**

# TREES, PLANTS AND GROUND COVERS

### PART 1: GENERAL

#### 1.01 SCOPE OF WORK

- A. Furnish all labor, materials, and equipment to provide, install, and maintain soil preparation, headers, finish grading, planting, and establishment period as described herein and on the plans.
- B. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damage, injury, and loss due to his acts or negligence.
- C. Work not included: Rough grading.

#### 1.02 QUALITY ASSURANCE

- A. Verify the locations of all existing utilities, structures, and services before commencing work. The locations of utilities, structures, and services shown on these plans are approximate only. Any discrepancies between these Plans and actual field conditions shall be reported to the Landscape Architect.
- B. Protect all existing utilities and features on and adjacent to the project site during construction. Contractor shall repair, at his own expense, all damage resulting from his operations or negligence.
- C. The Contractor shall obtain the pertinent engineering and or architectural plans before commencing work.
- D. Notify the Landscape Architect prior to commencing work, and be responsible for coordinating work with the Owner, Landscape Architect, other construction trades, and governing agencies.
- E. The planting plan is diagrammatic, and all plant locations depicted thereon are approximate. Plant symbols take precedence over plant quantities specified, if any. Notify the Landscape Architect of discrepancies between quantities and symbols shown.
- F. Prior to planting, the irrigation system shall be fully operational and all planting areas shall be thoroughly moistened to a depth of 24 inches.
- G. The Contractor shall be responsible for and pay for all permits and Certificates of Inspection of plant materials that may be required by Federal, State, or other authorities. Copies of permits and inspection certificates shall be furnished to the owner without charge.



H. Protect bench marks, existing structures, fences, roads, sidewalks, lawns, and other finish surfaces against damage from equipment or other planting operations. Repair any damage at no cost to Owner.

#### 1.03 SUBMITTALS

- A. Obtain, pay for, and submit to the Landscape Architect a soil analysis report from an authorized soil testing agency to the Landscape Architect prior to commencement of work. Soil amendments listed below are subject to change per this soil analysis.
- B. If a plant is found not to be suitable or available, the Contractor shall notify the Landscape Architect in writing prior to bidding. The Landscape Architect will select a suitable alternate and/or inform contractors of the availability of the plant.
- C. Submit photographs from the nursery of one (1) typical tree of each species tagged for shipment and installation on this project. Photographs shall show trees of size and branching structure typical of those supplied for each species. Landscape Architect reserves the right to reject plant material on site that does not meet the standard established by the approved photographs. Replacement of rejected trees shall be at the contractor's expense.

#### 1.04 MODIFICATIONS

- A. Design modifications may be made only as necessary to meet field conditions. Planting shall be located where shown on the plans except where obstructions below ground or overhead are encountered, or as approved by the Landscape Architect.
- B. Exact positioning of box trees will be determined in the field. Position materials as directed by the Landscape Architect.

#### PART 2: PRODUCTS

#### 2.01 PLANTING MATERIALS

- A. Plants shall have a habit of growth that is normal for the species and shall be symmetrical, sound, healthy, vigorous, and free of insect pests, plant disease, and injury. Trees shall not have crossing branches or weak branch structures atypical of their species.
- B. Root bound plant material is not acceptable. Five gallon plants and larger shall be grown in their containers for a minimum of six months and a maximum of two years. All plant material shall be subject to inspection and possible rejection prior to installation.
- C. All plants shall equal or exceed the measurements specified in the plant list, which are minimum acceptable sizes.
- D. Substitutions for indicated plant materials will not be permitted without the prior written approval of the Landscape Architect. Substitutions are to be at no additional cost to the Owner. If accepted substitute materials are of less value that those



originally specified, the contract price will be adjusted in accordance with the provisions of the contract.

E. In all cases, quantities of plant materials shall be furnished as needed to complete the work and indicated on the drawings, including reseeding, redressing, and maintenance (replacements) during the contract period.

#### 2.02 PLANTING MIXES, SOILS AND FERTILIZERS

- A. The following soil amendments are to be used as the basis for bids. Once site improvements are in place and approximate finish grades established, the Contractor shall furnish to the Landscape Architect a soils test made from the surface and subsurface (18" below grade) soil by an approved agricultural lab. The report shall include Ph. N / P / K. sar. ece. boron levels, and soil particle evaluation. Actual soil amendments to be installed may be adjusted by the Landscape Architect based on the findings of the report.
- B. General soil preparation, amount per 1,000 square feet:

3 cubic yards nitrogen fortified redwood shavings 200 pounds agricultural gypsum 15 pounds soil sulfur 7 pounds 16-6-8 fertilizer

- C. Soil: Plant backfill shall be native site soil, amended as noted on the plans and in accordance with soil test results.
- D. Import soil or topsoil shall be natural, friable soil possessing the same characteristics of the existing site soil. Provide topsoil free from subsoil, brush, objectionable weeds, rocks, organic or inorganic debris, and clay. Soil shall be free of toxic substances, soil sterilants, and salts. Do not provide soil from roadbed excavations. Import soil shall be tested as noted for native soil.
- E. Backfill soil for planters shall be of the following composition, premixed by machine blender prior to delivery to the site.

Six (6) parts well rotted sifted compost

Three (3) parts sandy loam soil

One (1) part by volume washed plaster sand

Two (2) lbs. per cu. Yd. Micro-Max Plus micronutrient Complex, or equal

Two (2) lbs. per cu. Yd. 16-6-8 fertilizer

#### TREE STAKES 2.03

A. Tree stakes shall be 2" diameter by 10' long new lodge pine poles treated with copper napthenate unless otherwise noted.



# PART 3: EXECUTION

### 3.01 SCHEDULING

A. Planting shall not commence until completion of all construction work, grading, soil preparation, weed control and sprinkler installation.

# 3.02 PRE-PLANTING

- A. Apply "Round-up" systemic herbicide (or approved equal) per manufacturer's specifications to existing undesired vegetation ten (10) days prior to commencement of any planting or irrigation work.
- B. All areas to be planted, which have a slope of 2:1 or less shall be cross-ripped to a depth of six (6) inches and soil amendments spread evenly as specified and thoroughly blended-in per 1,000 square feet.
- C. Maintain proof of delivery for all planting amendments on-site and available for inspection until acceptance of the entire installation.

#### 3.03 FINISH GRADING

- A. Finish grading after soil preparation shall establish final flow lines and gradients for uniform water drainage. Flow lines and gradients shall be established from the high point to the drainage outlet or an inlet structure.
- B. Rake-out and remove all rocks 1/2 inch diameter and larger from the top two inches of finished grade.
- C. Finished grades shall be 2" below the top of curbs, sills, and walkways in planting areas. At locations where drainage is to flow across hardscape, the grade shall be flush, or no more than 1/2" below hardscaping.
- D. Maintain a minimum 2% surface drainage away from all buildings in planting areas. Finished grades shall be raked and smoothed to eliminate puddling or standing water and allow smooth, even flow.

# 3.04 LAYOUT AND SPACING

- A. Stake locations of trees and outline planting areas as shown on plans. Obtain Landscape Architect's approval prior to excavation of plant pits. Landscape Architect reserves the right to interchange or shift plant locations prior to planting.
- B. When plant material is spaced in rows, the total dimension shall be verified, and the plants equally spaced within the designated area. Plants are to be installed in evenly spaced straight lines as shown on the plans to form hedges and mass plantings. Irregular plant spacing will not be acceptable.
- C. Ground cover material shall be triangularly spaced per dimension shown on the plans.



#### 3.05 PLANT MATERIAL INSPECTION

A. Review by the Landscape Architect of the plants upon delivery shall be for quality, size, and variety only, and shall not in any way impair the right of rejection for failure to meet other requirements during progress of the work.

#### 3.06 PLANTING

- A. Plant pits shall be as shown in the planting details. Roughen smooth pit walls caused by augering holes. Slick pit walls caused by augering in too wet soil will not be accepted.
- B. Plant material with root balls broken or cracked prior to or during planting operations shall not be planted.
- C. Each plant shall receive "Agriform" (or approved equal) plant tablets as follows:

1	gallon	container	1-21 gm	
5	gallon	container	2-21 gm	
15	gallon	container	3-21 gm	
per	6 inch	boxed tree size	1-21 gm	

- D. Backfill pit with planting mix half-way to finish grade and water thoroughly. Backfill to finish grade and tamp firm. Form a shallow basin around each plant pit as detailed.
- E. Remove nursery stakes on all vines and attach to adjacent wall or fence with green plastic vine ties.
- F. Remove nursery stakes from all container stock. Prune side growth on trees only as directed by Landscape Architect.
- G. Container plants shall not be placed within 12 inches of sprinkler heads.
- H. Shrubs and trees shown in planting areas shall be under-planted with groundcover shown by adjacent symbol, to within 12 inches of main plant stem.
- I. Upon completion of the work, all trees and shrubs shall have had any broken branches removed and injuries repaired. Clean and re-cut wounds over 3/4" and coat with tree wound paint.

#### 3.07 TREE STAKING

A. Stake all trees per details. Drive stake into firm soil next to root ball. Tree stakes shall be vertical in all cases. Nursery stakes are to removed except on shrub standards (Raphiolepis, Leptospermum, Photinia, etc.), where they are to remain until the end of the maintenance period.



### 3.08 FLATTED GROUND COVER

- A. Rooted cuttings shall be planted sufficiently deep to cover all roots, and shall be spaced as noted on the drawings.
- B. Rooted cuttings shall have been grown in flats and shall remain in those flats until time of transplanting. At time of transplanting the soil shall contain sufficient moisture so that the soil does not fall apart when lifting plants from the flat. Each plant shall be planted with its proportionate amount of soil in a manner that will ensure a minimum of disturbance to the root system.
- C. Rooted cuttings shall not be allowed to dry out or wilt before or during planting. Wilted plants will not be accepted.
- D. At the time of planting each ground cover plant, the earth shall be firmed sufficiently to force out air pockets. Water ground cover beds immediately after planting.

#### 3.09 MULCHING

A. When planting operations are complete and shrub areas have been raked and dressed, mulch all shrub areas with a 3" layer of shredded fir bark (Walk-on Bark or approved equal). Mulch flatted ground cover beds prior to planting.

#### 3.10 PROTECTION AND CLEAN-UP

- A. The Contractor shall carefully and continuously protect all areas included in the contract, including lawn areas, plant material, supports, etc. until final acceptance by the Owner. Repair and/or replace any damaged areas at no additional cost to the Owner.
- B. After planting operations are completed, the Contractor shall remove all trash, excess soil, empty plant containers, and other accumulated debris from the site. Leave the site in a clean, washed condition, removing all unused material, trash, and tools.

#### 3.11 INSPECTIONS

- A. The Contractor shall give 48 hours notice and set appointments for the review of the following operations by the Landscape Architect:
  - Finish grading
  - · Review of plant material after delivery to the site
  - Tree and shrub placement prior to digging holes
  - Ground cover lines and headerboard placement
  - Pre-maintenance period walk-thru
  - Post maintenance / Final Acceptance walk-thru
- B. In the event the Contractor requests inspection of the work, and said work is substantially incomplete, the Contractor shall be responsible for the Landscape Architect's hourly charges and per diem.



#### 3.12 COMPLETION AND WALK-THRU

A. At the completion of all work as outlined on these plans, the Landscape Contractor shall contact the Landscape Architect and schedule a review of said work ("walk-thru") to determine that all aspects of work are complete. Work must be fully completed according to all drawings and specifications, and must be accepted by the Owner in writing prior to commencement of the maintenance period.

# 3.13 MAINTENANCE AND ACCEPTANCE

- A. The Contractor shall continuously maintain all areas included in the contract during the progress of the work, through the establishment period, and until final acceptance of the work.
- B. The Contractor shall maintain all plantings for a period of Ninety (90) calendar days after approval of completion and notification in writing of the start of the maintenance period. The maintenance period shall include the following scope of work:
  - 1. Daily watering of all plant material.
  - 2. Removal of all weeds from planting areas.
  - 3. Replacement of any dead, dying, or damaged trees, shrubs, or ground covers.
  - 4. Proper adjustment and maintenance of the irrigation system.
  - 5. Filling, recompaction, and replanting of any eroded or settled areas.
  - 6. Weekly removal of all trash, litter, clippings and foreign debris.
  - 7. Disease, insect and rodent prevention and control measures.
  - 8. At 30-days after completion of planting, apply ammonium phosphate at the rate of 5 lbs. per 1,000 square feet to all planting areas.
  - 9. At 60-days after completion of planting, apply 16-6-8 fertilizer at the rate of 3 lbs. per 1,000 square feet to all planting areas.
- C. Any day the Contractor fails to adequately water, replace unsuitable plants, weed, or other work of the maintenance period will not be credited towards the completion of the period. Plants and lawns which decline due to lack of Contractor maintenance shall be replaced by the Contractor at his expense.
- D. Prior to the end of the maintenance period, again contact the Landscape Architect to schedule a final review ("walk-thru"). The Owner must accept all maintained areas in writing to ratify the end of the maintenance period.
- E. If, during the maintenance period, on site observations by the Landscape Architect or Owner determine that proper maintenance procedures are not being followed, the Contractor will be notified in writing. Corrections shall be made within two working days of notification, or the Owner may elect to extend the maintenance period beyond 90 days, such extension being equal to the amount of time required to correct the maintenance practices.

# 3.14 PROTECTION



- A. The Contractor is responsible for protecting the work covered by this section from vandalism and accidental damage. Any damage shall be promptly repaired by the Contractor at no additional cost to the owner.
- B. The Contractor is responsible for protecting the work covered by this section from damage caused by frost or torrential rains. Any damage shall be promptly repaired by the Contractor at no additional cost to the owner.

#### **GUARANTEE** 3.15

- A. All shrubs, ground covers and 5 gallon size trees or less shall be guaranteed as to growth and health for a period of ninety (90) days after final acceptance by the owner. 15 gallon and all box sized trees and larger shall be guaranteed for a period of one year after final acceptance by the owner.
- B. Plants that die or loose more than thirty percent (30%) of their leaf or branching structure shall be replaced under this section.
- C. The Contractor, within fourteen (14) days of written notification by the owner, shall remove and replace all guaranteed plants that for any reason fail to meet the requirements of the guarantee. All plant materials replaced shall be guaranteed for the original period, beginning with the date of replacement.

**END OF SECTION** 



### **SECTION 33 05 16**

### **UTILITY STRUCTURES**

#### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Section includes the following:
  - 1. Handholes and boxes.
  - 2. Manholes.
  - 3. Utility Vaults
  - 4. Utility Structures
  - 5. Related Divisions 26 Electrical, 27 Communications, 33 Utilities.

#### 1.2 SUBMITTALS

- A. Product Data: For the following:
  - 1. Accessories for manholes, handholes, boxes, vaults, and utility structures.
- B. Shop Drawings for Precast Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
  - 1. Reinforcement details.
  - 2. Frame and cover design and manhole frame support rings.
  - 3. Ladder details.
  - 4. Joint details.
- C. Product Certificates: For concrete and steel used in precast concrete structures as required by ASTM C 858.

# 1.3 DESIGN LOADS

A. Design wheel loads: (16) kips. Reference document ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Structures.

# 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store precast concrete underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- B. Lift and support precast concrete units only at designated lifting or supporting points.

### 1.5 COORDINATION

A. Coordinate layout and installation of utility structures with final arrangement of other utilities, site grading, and surface features as determined in the field.



B. Coordinate elevations of ducts and duct-bank entrances utility structures with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features.

# PART 2 - PRODUCTS

### 2.1 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carder Concrete Products.
  - 2. Christy Concrete Products.
  - 3. Elmhurst-Chicago Stone Co.
  - 4. Oldcastle Precast Group.
  - 5. Riverton Concrete Products; a division of Cretex Companies, Inc.
  - 6. Utility Concrete Products, LLC.
  - 7. Utility Vault Co.
  - 8. Jansen Precast, Fontana CA.
- B. Or equal in accordance with Division 01 for Substitutions.
- C. Comply with ASTM C 858 for design and manufacturing processes.
- D. Description: Factory-fabricated, reinforced-concrete, enclosures. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
  - 1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
  - 2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 3. Cover Legend: Molded lettering, "ELECTRIC", "TELEPHONE." And as indicated for each service.
  - 4. Configuration: Units shall be designed for flush burial and have open, closed or integral closed bottom, as required for the application unless otherwise indicated.
  - 5. Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    - Extension shall provide increased depth of 12 inches.
    - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
  - 6. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    - a. Type and size shall match fittings to duct or conduit to be terminated.
    - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
  - 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
  - 8. Compressive Strengths: Minimum strength of 5500 PSI at 28 days.

# 2.2 PRECAST MANHOLES

A. Comply with ASTM C 858 and with interlocking mating sections, complete with accessories, hardware, and features.



- 1. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
- B. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.
- C. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
  - 1. Accessories: Joint Sealant for gasketing of concrete sections flexible butyl resin sealant, ASTM C990, Concrete Sealants CS-102 and CS-202 by ConSeal by Concrete Sealants Inc., New Carlisle, Ohio, or equal.

#### 2.3 UTILITY STRUCTURE ACCESSORIES

- A. Manhole Frames, Covers: Comply with structural design loading specified for manhole.
  - 1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches.
    - Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
  - 2. Cover Legend: Cast in.
    - Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
    - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
    - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
    - d. Legend: "SEWER" for sanitary sewer manholes.
    - e. Legend: "WATER" for domestic water valve can covers.
    - f. Legend: "F-WATER" for Fire water valve can covers.
    - g. Legend: "STORM DRAIN" for private Storm Drain cleanout structures
- B. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.
- C. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch-(50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.
  - 1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.
- D. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
  - 1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.
- E. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive



thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (32 mm) minimum at base.

- 1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.
- F. Cable Rack Assembly: Steel, hot-rolled or hot-dip galvanized, except insulators.
  - 1. Stanchions: T-section or channel; 2-1/4-inch (57-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
  - 2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (460 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
  - 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- G. Fixed Manhole Ladders: Arranged for attachment to roof and floor of manhole. Ladder and mounting brackets and braces shall be fabricated hot-dip galvanized steel.
- H. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater, Two required.
- Accessories: Joint Sealant for gasketing of concrete sections flexible butyl resin sealant, ASTM C990, Concrete Sealants CS-102 and CS-202 by ConSeal by Concrete Sealants Inc., New Carlisle, Ohio, or equal

#### 2.4 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

#### PART 3 - EXECUTION

#### 3.1 UNDERGROUND ENCLOSURE

- A. Handholes and Boxes for 600 V and Less
  - 1. Refer to Division 26 and 27.
  - 2. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, structural load rating.
  - 3. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20structural load rating.
  - 4. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10structural load rating.
  - 5. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Manholes: Precast concrete.
  - Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.



2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

# 3.2 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 Section "Earthwork," but do not use heavy-duty, hydraulic-operated, compaction equipment.
  - 1. Shoring of the excavation shall be in accordance with all state and local regulations.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
  - Remove shoring and complete the backfilling. Remove the shoring from the bottom up. Release the jacks or braces slowly. Use chains or wire ropes to pull out the jacks or braces from above.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Sections "Lawns and Grasses" and "Exterior Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 1 Section "Cutting and Patching."
- E. Provide six (6) inches of base material at the bottom of the excavation, level and compacted to the proper elevation in conjunction with the conduit and the conduit entrance of vaults/manholes as designated on the utility plans.
- 3.3 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES
  - A. ASTM C-891 Standard Practice for the Installation of Underground Precast Concrete Utility Structures.
  - B. Precast concrete utility structure shall be lifted at the lifting points so designated by the manufacturer.
  - C. Precast Concrete Handhole and Manhole Installation:
    - 1. Comply with ASTM C 891, unless otherwise indicated.
    - 2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
    - 3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
      - a. Assemble the multi-section utility structures by lowering each section into the excavation. Lower, set level, and firmly position the base section before placing the additional sections.
      - b. Seal material at joints between sections, or at the manufacturer's plant.



At mortar grout joints provide a minimum of 3/8 in. (10-mm) thickness of mortar on all joint surfaces. After assembly, dress the interior joint to remove excess mortar.

#### D. Elevations:

- Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished 1.
- 2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
- 3. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- Where indicated, cast handhole cover frame integrally with handhole structure. 4.
- Unpaved area, slope the area around the entrance frame and cover to provide drainage away from the entrance cover. Slope the final grading upward to within 1 inch of the top surface of the frame and cover.
- Drainage: Install drains in bottom of manholes where indicated. Coordinate with E. drainage provisions indicated.
- F. Manhole Access: Circular opening in manhole roof; sized to match cover size.
  - Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
  - 2. Install collars, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisturetight masonry joints and waterproof grouting for cast-iron frame to chimney.
- G. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07 Section Elastomeric Sheet Waterproofing. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole collar after mortar has cured at least three days.
- H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, as required for installation and support of cables and conductors and as indicated.
- I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill J. deeper than 3-7/8 inches (98 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
- K. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.



# 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of utility structures.
  - 2. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 16 Section "Grounding and Bonding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

# 3.5 CLEANING

A. Clean internal surfaces of structures, remove foreign material.



## **SECTION 33 11 00**

#### **WATER SYSTEM**

#### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

A. Construction of on-site water service facilities and appurtenances, including the installation and testing of water system and services indicated for domestic water services, and private Fire service loop. The Contractor shall furnish and install pressure reducing valves, double check detectors, reduced pressure backflow preventers, blowoffs, air release valves, gate valves and appurtenances, in accordance with the Governing Water District.

#### 1.02 REFERENCES

# A. Geotechnical Report:

- 1. Geotechnical investigation as been prepared under the direction of the Owner. Investigation is hereby referenced as information for the work of this section. Architect / Engineer assume no responsibility for conclusions the Contractor may draw, from information provided. The Contract Documents take precedence over recommendations that may be contained in the investigation and the contractor must obtain approval for any and all deviations from the Contract Documents. Copy of investigation is available at Architect's office. Copy investigation is bound herein as a reference only.
- B. Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
  - 1. Standard Specifications:
    - a. Standard Specifications for Public Works Construction (Latest Edition).
    - b. CalTrans-Manual of Traffic Controls for Construction and Maintenance Work Zones, Latest Edition.
  - 2. Standard Drawings:
    - a. Standard Drawings, issued by Governing Water District, shall apply to the work to the extent referenced on plans. Rainbow Municipal Water District
    - b. Equivalent Materials List, Governing Water District Standard Specifications.
    - c. San Diego County Regional Standard Drawings, Latest Edition

## C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D1785 1999 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80

and 120

- 2. ASTM D2466 2001 (Vinyl Chloride) (PVC) Plastic Pipe Fitting, Schedule 40
- 3. ASTM D2564 1996 Solvent Cements for Polyvinyl Chloride (PVC) Plastic

## Pipe and Fittings

4. ASTM D2774 2001 Underground Installation of Thermoplastic



D.

E.

F.

1.03

Α.

B.

Pressure Piping 5. ASTM D2855 1996 Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings 6. ASTM F402 1999 Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings AMERICAN WATER WORKS ASSOCIATION 1. AWWA C-900 1997 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings 4 in. through 12 in., for Water District AWWA C-509 2001 Resilient-Seated Gate Valves for Water 2. Supply Service 3. AWWA C-800 2001 Underground Services Line Valves and **Fittings** 2002 PVC Pipe-Design and Installation 4. AWWA M-23 1995 Concrete Pressure Pipe 5. AWWA M9 UNDERWRITERS LABORATORIES, INC. (UL) UL 262 1994 Gate Valves for Fire Protection Service, 1. Seventh Edition 2. UL 312 1993 Check Valves for Fire Protection Service **Eight Edition** 1993 Indicator Posts for Fire Protection Service. 3. UL 789 Ninth Edition UNI-BELL PLASTIC PIPE ASSOCIATION (UBPPA) 1. UBPPA UNI-B-8 1986 Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe **SUBMITTALS** Manufacturer's Catalog Data: Pipe and Fittings 1. 2. Joints and Couplings Valves, including above-ground double check detector, post indicator 3. valve and gate valves, reduced pressure Back Flow Preventer Valve and Meter Boxes 4. Manufacturer's standard drawings or catalog cuts.

C. Certificates of Compliance:

Pipe and Fittings
 Pipe Joint Materials

Valves

D. Certificates shall attest that products meet the requirements of the Governing Water District and that tests set forth in each applicable referenced publication have been



performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

## 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage. Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
- B. Handling. Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Carry, do not drag pipe to the trench. Store plastic piping, jointing materials that are not to be installed immediately, under cover out of direct sunlight.

# PART 2 - PRODUCTS

## 2.01 WATER SERVICE LINE MATERIALS

# A. Piping Materials:

- 1. Plastic piping and fittings shall bear the seal of the National Sanitation Foundation for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer and shall be in accordance with the Governing Water District's, "Equivalent Material List" contained in their standard specifications.
  - a. Polyvinyl Chloride (PVC) Plastic Piping: SDR 14 with Class 200 pressure rating manufactured in accordance with AWWA Standard C900, unless otherwise noted. Rubber water-lock rings shall be supplies by pipe supplier.
- Ductile Iron Piping (DIP): Ductile iron pipe shall be pressure Class 350 with Tyton joints unless otherwise noted on plans and manufactured in accordance with AWWA standard C151. Ductile iron pipe and fitting shall be supplied by the same manufacturer and shall be in accordance with the governing District's approved materials list contained in their standard specifications.

#### B. Valves and Valve Covers:

- 1. Gate Valves and Butterfly Valves:
  - a. Gate valves, including tapping valves, shall be resilient seat gate valves manufactured in accordance with AWWA standard C509.
  - b. Butterfly valves shall be manufactured in accordance with AWWA Standard C504. Both gate valves and butterfly valves shall be listed on Governing Water District's approved materials list.
- 2. Gate Valve Covers and Gate Cans:



- a. All gate valve covers shall be 8 inch diameter cast iron, have the word "Water" in raised letters on top. Gate material shall be 8 inch I.D. PVC pipe, schedule 40.
- 3. Post Indicator Valves, Double Detector Check Valves, and Check Valves . Comply with the Governing Water District's approved material list.
- 4. Reduced Pressure Detector Assemblies shall be Febco Master Series LF866 or equal.
- C. Precast Meter Boxes and Vaults. Comply with the Governing Water District's approved material list and the standard drawings referenced on the plans.
- D. Water Main Appurtenances. All water main appurtenances including, but not limited to fire hydrants, water meters, fire department connections, air and vacuum release valves, tapping sleeves, blow off assemblies, water services, brass fittings and iron fittings shall comply with the Governing Water District's approved materials list.

#### PART 3 - EXECUTION

## 3.01 INSTALLATION OF PIPELINES

- A. Installation of all water mains, appurtenances and water service shall conform to the Governing Water District's standard specifications.
- B. The Contractor shall notify Underground Service Alert at 1-800-422-4133 at least two (2) days prior to starting work and shall coordinate all work with utility company representatives. The existence and locations of existing underground facilities indicated on the plans were obtained from a search of available records. The Contractor shall take precautionary measures to protect any existing facility indicated on the plans, and any other which is not of record or indicated on the plans.
- C. Prior to commencing the work, the Contractor shall <u>POTHOLE EXISTING UTILITIES</u> at points of connection.
- D. Contractor shall coordinate locations of stub-outs from buildings with building plumbing Contractor.
- E. Installation of Water Service Piping:
  - 1. Location:
    - a. Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; such water service lines shall be closed with plugs or caps.
  - 2. Service Line Connections to Water Mains:
    - a. Domestic Service:
      - 1. The Contractor shall be responsible to install the service lateral, 2" ball valve curb stop with PVC pack joint inlet and outlet per the Governing Water District's standard drawings set in a No. 3 Water meter box with extensions. The Contractor shall be responsible to continue water service piping from the 2" water stop to the building terminus as specified in Paragraph 3.01A. above.



- b. Fire Sprinkler Service:
  - The Contractor shall be responsible to install fire service piping from the connection at main to the building terminus as specified in Paragraph 3.01A. above, including installation of above-ground double check detector assembly, reduced pressure backflow preventer, post indicator valve, thrust blocks, and calculations, and fire department connection as indicated.
- F. Special Requirements for Installation of Water Service Piping:
  - 1. Installation of Plastic Piping:
    - a. Install pipe and fittings in accordance with Section 306-1.2, 306-1.2.13 of the standard specifications and the applicable requirement of ASTM D2774 and ASTM D2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F402.
      - Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer. Make push-on joints in accordance with the recommendations of the manufacturer.
      - 2. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

# G. Pipe Anchorage:

- 1. Provide concrete thrust blocks for water mains and fire service laterals in accordance with the Governing Water District's standards.
- H. Trenching and Buried Warning Tape. Perform earthwork operations in accordance with Section 31 23 17, Trenching, including installation of buried warning tape.
- Disinfection. Flush and disinfect all new water lines including reclaimed water lines and affected portions of existing potable water lines in accordance with AWWA C651. Apply chlorine by the continuous feed method.

## 3.02 FIELD QUALITY CONTROL

- A. Field Tests and Inspections:
  - 1. The Contractor shall perform pipeline testing in accordance with Section 306-1.4 of the standard specifications and the Governing Water District's standard specifications.
  - 2. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications.

## B. Testing Procedure:

 Test water mains and water service lines in accordance with the applicable specified standard. Test PVC plastic water service lines made with PVC plastic water main pipe in accordance with the requirements of UNI B3 for pressure and leakage tests. Test water service lines in accordance with



applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at plastic pipe joints.

- C. Special Testing Requirements:
  - 1. For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger that 2 inches in diameter, hydrostatic test pressure shall be not less that 200 psi. Hold this pressure not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.



## **SECTION 33 31 00**

#### **SANITARY SEWAGE SYSTEMS**

## PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Sanitary drainage piping, fittings and accessories.
- B. Connection of building sanitary drainage system to site sewer systems.
- C. Cleanout access.
- D. Connection of site sewer system to [campus] [municipal] sewer system unless indicated otherwise on Drawings.
- E. Grease Interceptor

## 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents. Drawings reference County of San Diego Regional Standard Drawings
- B. ASTM D2751 Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- C. SSPWC Standard Specifications for Public Works Construction, Latest Edition.
- D. APWA American Public Works Association.
- E. ANSI / ASTM D3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

## 1.03 REGULATORY REQUIREMENTS

A. Conform to Section 306, Standard Specifications for Public Works Construction, for materials and installation of Work of this Section.

#### 1.04 SUBMITTALS

- A. Product data for pipe and pipe accessories.
- B. Project Record Documents
  - Accurately record location of pipe runs, connections, manholes, cleanouts and invert elevations.
  - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.



#### PART 2 - PRODUCTS

## 2.01 SEWER PIPE MATERIALS

- A. Plastic Pipe: ASTM D2751, acrylonitrile-butadiene-styrene (ABS) material; sizes; bell and spigot style solvent sealed end joints.
- B. VC gravity sewer pipe shall be made of PVC plastic having a cell classification of 12454-B, 13364-A, or 13364-B as defined in ASTM D1784. PVC gravity sewer pipe, fittings, coupling and joints, 4-inch through 15-inch, shall be manufactured in conformance with the requirements of ASTM D3034, SDR 35 and shall have gasketed joints. All pipe shall be of solid wall construction with smooth interior and exterior surfaces..
- C. Hub and Spigot, Cast-Iron Soil Pipe and Fittings: ASTM A74, Service class, gray cast iron for gasketed joints. Include ASTM C564, rubber compression-type gaskets.

#### 2.02 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene-ribbed gasket for positive seal.
- B. Any fittings shall also be made of PVC plastic and have a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM D1784. PVC gravity sewer pipe, fittings, coupling and joints, 18-inch through 21-inch, shall be manufactured in conformance with the requirements of ASTM F679 with T-1 wall thickness and shall have gasketed joints. All pipe shall be of solid wall construction with smooth interior and exterior surfaces. The minimum pipe stiffness for both small diameter and large diameter PVC gravity sewer pipe shall be 46 psi according to ASTM D2412.
- C. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D3034, SDR 35, for solvent-cemented or gasketed joints.
  - 1. Gaskets: ASTM F477, Elastomeric seals.

## 2.03 CLEANOUTS

- A. Lid and Frame: Cast iron construction, removable lid, closed checkerboard grill lid design; nominal lid and frame diameter as required for pipe sizes. (APWA 304-0) SDRSD SC-01
- B. Manholes: Rainbow Municipal Water District standard drawing S-5

#### 2.04 FILL MATERIAL

A. Bedding and Fill: As specified in Section 31 23 17.

# **HMC** Architects

#### PART 3 - EXECUTION

## 3.01 EXAMINATION

- A. Verify that trench cut or excavation base is ready to receive work, excavations, dimensions and elevations are as indicated on Drawings.
- B. Beginning of installation means acceptance of existing conditions.
- C. Verify that existing invert elevations on site will allow proper tie in to new work with proper positive slope. Ascertain accuracy prior to trenching and installation of sanitary sewer system.

## 3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with approved fill material.
- B. Remove large stones or other hard matter that could damage sewer pipe or impede consistent backfilling or compaction.

## 3.03 INSTALLATION - PIPE

- A. Prior to commencing Work, Contractor shall pothole existing utilities at points of connection. Notify Architectin event of discrepancies.
- B. Install pipe, fittings and accessories in accordance with Section 306, SSPWC and manufacturer's instructions. Seal joints watertight.
- C. Place pipe on bedding as specified in Section 31 23 17.
- D. Lay pipe to slope gradient noted on Drawings with maximum variation from true slope of 1/8 inch in 10 feet.
- E. Do not displace or damage pipe when compacting.
- F. Connect to site sewer outlet system through installed sleeves.
- G. Do not cover joints until lines have been tested and approved.

## 3.04 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Establish elevations and pipe inverts.
- C. Mount lid and frame level in grout secured to top cone section to elevation indicated.



# 3.05 PROTECTION

A. Protect pipe cover from damage or displacement until backfilling operation is in progress.



#### **SECTION 33 41 00**

#### STORM DRAIN SYSTEMS

## PART 1 - GENERAL

# 1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.
- B. Connection of building storm water drainage system to site storm drains.
- C. Catch basins, paved area drainage, manhole access and site surface drainage.

#### 1.02 REFERENCE STANDARDS

- A. Conform to reference standards by date of issue current on date of Contract Documents.
- B. San Diego County Regional Standard Drawings, Latest Edition.
- C. CPC California Plumbing Code, 2010, Chapter 11.
- D. ASTM A74 Cast Iron Soil Pipe and Fittings.
- E. ASTM C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- F. ANSI/ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- G. ANSI/ASTM D2729 Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- H. ANSI/ASTM D3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- I. ANSI A21.11 Rubber Gasket Joints for Cast Iron and Ductile-Iron Pressure Pipe and Fittings.
- J. SSPWC Standard Specifications for Public Works Construction, Latest Edition.
- K. APWA American Public Works Association.

## 1.03 REGULATORY REQUIREMENTS

A. Conform to Section 306, SSPWC, code for materials and installation of the Work of this Section.

#### 1.04 SUBMITTALS

A. Shop drawings indicating dimensions, locations and elevations of catch basins, manholes, cleanouts and subsurface structures.



- B. Product data indicating pipe and pipe accessories.
- C. Project Record Documents
  - Accurately record location of pipe runs, connections, catch basins, manholes, cleanouts and invert elevations.
  - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

# PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS - STORM DRAIN PIPE MATERIALS

- A. Products of the following manufacturers form the basis for design and quality intended.
  - 1. Cast Iron Pipes
    - a. Precast Products, Garden Grove, CA.
  - 2. Reinforced Concrete Pipes, Manholes, Utility Structures
    - a. Johnson Bateman Co., Ontario, CA.
    - b. Precast Products, Garden Grove, CA.
    - c. Jensen Precast, Fontana, CA.
  - 3. PVC Pipe
    - a. Diamond Plastic Corp., Grand Island, NE.
    - b. Advanced Drainage Systems, Inc., Hilliard, OH.
  - 4. HDPE Pipe
    - a. Advanced Drainage Systems (ADS), Inc. Hillard. OH
- B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

## 2.02 STORM DRAIN PIPE MATERIALS

- A. Cast Iron Pipe: ASTM A74; service type; plain end joints.
- B. Cast Iron Pipe Joint Device: ANSI A21.11, rubber gasket joint device.
- C. Reinforced Concrete Pipe: ASTM C76, with wall Type B; mesh or bar reinforcement; plain end joints.
- D. Reinforced Concrete Pipe Joint Device: ASTM C443, rubber compression gasket joint.
- E. Plastic Pipe: ASTM D2729, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.
- F. Plastic Pipe: ASTM D3034, Type PSM, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.
- G. HDPE Pipe: ASSHTO M294 Type "S" water tight joints tested in accordance with ASTM D 3212 for 5.0 psi (Low Head) (ADS N-12 WT).
- 2.03 PIPE ACCESSORIES



- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- B. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts, reducers, traps, and other configurations required.

# 2.04 CATCH BASINS

- A. Basin Lid and Frame: Welded steel grating construction conforming to ADA spacing requirements, hinged lid, linear grill lid design.
  - 1. Grid/Openings limited to 1/2 Inch maximum with direction of grate slots perpendicular to path of travel.
- B. Shaft Construction and Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints.
- C. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00; leveled top surface to receive concrete shaft sections, sleeved to receive pipe sections.
- D. Accessories: Joint Sealant for gasketing of concrete sections flexible butyl resin sealant, ASTM C990, Concrete Sealants CS-102 and CS-202 by ConSeal by Concrete Sealants Inc., New Carlisle, Ohio. Or equal.
- E. Approved drawings reference San Diego County Regional Standard Drawings, Latest Edition.

## 2.05 MANHOLES AND CLEANOUTS

- A. Lid and Frame: Cast iron construction, removable lockable lid, closed lid design; nominal lid and frame diameter of 26 inches; manufactured by Brooks Products, or equal.
- B. Shaft Construction and Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints; cast steel ladder rungs into shaft sections at 12 inches; nominal shaft diameter of 48 inches; manufactured by Brooks Products, or equal.
- C. Base Pad: Cast-in-place concrete of type specified in Section 32 13 13; leveled top surface to receive concrete shaft sections, sleeved to receive storm drain pipe sections.
- D. Accessories: Joint Sealant for gasketing of concrete sections flexible butyl resin sealant, ASTM C990, Concrete Sealants CS-102 and CS-202 by ConSeal by Concrete Sealants Inc., New Carlisle, Ohio. Or equal.
- E. Cleanouts: Iron body type; extra heavy bronze plugs; manufactured by Acorn Engineering Co., J.R. Smith Mfg. Co., or F.A. Zurn Mfg. as follows:
  - 1. Concrete areas: non skid nickle bronze lid, set flush with surface; Acorn 120-11, Smith 4240, or Zurn Z-1326-10.



- 2. Non surface and asphalt surface areas: Non skid extra heavy cast iron cover; Acorn 120-10, Smith 4240, Zurn Z-1326-10.
- F. Approved drawings reference County of San Diego County Regional Standard Drawings, Latest Edition

#### 2.06 FILL MATERIAL

A. Bedding and Fill: Type specified in Section 31 23 17.

#### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify that trench cut or excavation base is ready to receive work.
- B. Verify existing invert elevations for proper tie-in of new work prior to trenching and installation of storm drain system.
- C. Beginning of installation means acceptance of existing conditions.

## 3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with approved fill material.
- B. Remove large stones or other hard matter that could damage drainage pipe or impede consistent backfilling or compaction.

#### 3.03 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with Section 306, SSPWC. Seal joints watertight.
- B. Place pipe on bedding as specified in Section 31 23 17.
- C. Lay pipe to slope gradients noted on drawings, with maximum variation for true slope of 1/8 inch in 10 feet.
- D. Install bedding at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.
- E. Place bedding in maximum 8 inch lifts, consolidating each lift.
- F. Do not displace or damage pipe when compacting.
- G. Connect to storm drain municipal system through installed sleeves. Do not cover joints until lines have been tested and approved.
- 3.04 INSTALLATION CATCH BASINS, MANHOLES AND CLEANOUTS



- A. Install per Standard Specifications for Public Works Construction.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Form and place cast-in-place concrete base pad, with provision for storm drain pipe end sections.
- D. Establish elevations and pipe inverts for inlets and outlets.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.
- 3.05 FIELD QUALITY CONTROL
  - A. Request inspection by Geotechnical Engineer prior to placing cover over pipe.
- 3.06 PROTECTION
  - A. Protect pipe and filter aggregate cover from damage or displacement until backfilling operation is in progress.